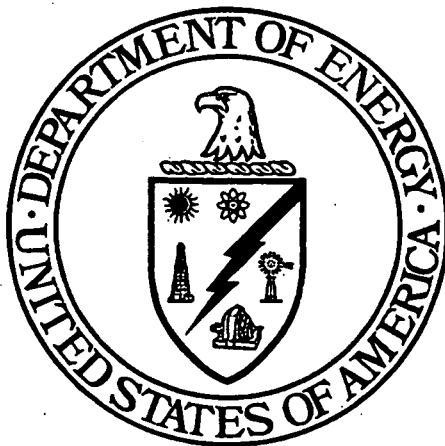


2264

**NATIONAL EMISSIONS STANDARDS  
FOR HAZARDOUS AIR POLLUTANTS (NESHAP)  
ANNUAL REPORT**

**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT  
FERNALD, OHIO**



**MAY 1999**

**U.S. DEPARTMENT OF ENERGY  
FERNALD AREA OFFICE**

**60200-RP-0002**

**REV. 0**

**FINAL**

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**1998 NATIONAL EMISSIONS STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP)**

**ANNUAL REPORT FOR THE  
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**

**U.S. Department of Energy  
Radionuclide Air Emissions Annual Report  
(under Subpart H of 40 CFR Part 61)  
Calendar Year 1998**

2264

**Site Name:** Fernald Environmental Management Project (FEMP), Fernald, Ohio

**Field Office Information:**

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**Site Information**

**Operating**

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**LIST OF ACRONYMS**

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ALARA	As Low As Reasonably Achievable
AMS	air monitoring station
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FEMP	Fernald Environmental Management Project
IEMP	Integrated Environmental Monitoring Plan
mrem	millirem
NESHAP	National Emission Standards for Hazardous Air Pollutants

**PREAMBLE**

On May 23, 1997, the U.S. Department of Energy (DOE) Fernald Environmental Management Project (FEMP) submitted a written request to the U.S. Environmental Protection Agency (EPA) for approval to use an alternate approach for demonstrating compliance with the National Emission Standards for Hazardous Air Pollutants (NESHAP), Subpart H requirements (DOE 1997b). The alternate approach utilizes environmental measurements of airborne radionuclide concentrations (as provided for under 40 Code of Federal Regulations [CFR] 61.93[b][5]) rather than air dispersion modeling to demonstrate that radionuclide emissions resulting from FEMP operations remain below the annual NESHAP Subpart H standard. The request for approval of the alternative approach was driven by the recognition that the dominant sources of radiological emissions at the FEMP had changed as the mission of the FEMP changed from uranium metal production (which ended in 1989) to environmental remediation. During production, the primary emission sources from the facility were point sources (stacks and vents); however, under the current mission of full scale environmental remediation, the dominant emission sources are fugitive emissions from diffuse sources (i.e., large scale excavations, wind erosion from stockpiled materials, and decontamination and dismantling projects, etc.). Because there is a high degree of uncertainty associated with modeling fugitive emissions, environmental measurements were proposed as an alternative to provide a more accurate assessment of FEMP emissions.

On August 11, 1997, the EPA granted approval to use environmental measurements as an alternative methodology for demonstrating NESHAP compliance (EPA 1997). 1998 was the first year the FEMP utilized environmental measurements for compliance purposes.

**SUMMARY**

For 1998, the maximum effective dose equivalent from emissions of radionuclides to the ambient air, based on radionuclide measurements at the FEMP fenceline, is estimated to be 0.26 millirem (mrem) (2.6E-03 mSv), which is in compliance with the Subpart H standard of 10 mrem. This estimation is based on the FEMP's radiological air particulate monitoring program which consists of a network of high volume air monitoring stations (AMS) operated continuously during the year at the FEMP facility fenceline and background locations.

## SECTION I: FACILITY INFORMATION

### A. Site Description

The FEMP is located on a 1,050 acre (425 hectare) area approximately 17 miles (27 km) northwest of Cincinnati, Ohio. The former production area covers approximately 136 acres (55 hectares) in the center of the FEMP. The facility is sited just north of the small farming community of Fernald, Ohio.

The area immediately surrounding the FEMP is primarily rural in nature, characterized by the predominance of agriculture, with some light industry and private residences. The FEMP is located on a relatively level plain, outside of the 500-year flood plain of the Great Miami River, in an ancestral river valley known as the New Haven Trough.

The climate is characterized as continental, with average temperatures ranging from approximately 29°F (-1.7°C) in January, to 76°F (24.4°C) in July. Average annual precipitation is approximately 41 inches (102 cm) per year. Prevailing wind flow is from the south-southwest.

For 37 years, the former Feed Materials Production Center (Fernald site) produced uranium metals for DOE and its predecessors. On July 10, 1989, uranium metals production was suspended. Management responsibilities of the Fernald site were transferred from the Defense Programs organization to the DOE's Office of Environmental Restoration and Waste Management.

Currently, most activities at the FEMP are conducted under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). These activities include sample analysis, waste characterization, the management, treatment, storage, and disposal of hazardous, mixed, low-level and solid wastes, and the decontamination and cleanup of radioactively contaminated buildings, equipment, soils, and waters. The site also manages thorium wastes, and K-65 Silo waste material which contains radium and produces radon gas.

## B. Source Descriptions

The majority of the airborne emissions at the FEMP consist of uranium and uranium compounds. Thorium, radium-226, and the radioactive decay products of uranium and thorium form the balance of airborne emissions.

1998 radionuclide emission sources at the FEMP included:

- Plant 6\*: Emissions from T-Hopper repackaging operations
- Plant 8: Shot blasting demonstrations
- Plant 9: Fugitive emissions generated from the Thorium/Plant 9 Complex above-grade decontamination and dismantlement project
- Building 11\*: Emissions from the laundry facilities resulting from the processing of contaminated clothing used at the FEMP, and from the respirator washing facility located in the building
- Building 15\*: Emissions from laboratory operations
- Building 51: Emissions from the advanced wastewater treatment facility
- Building 53: Emissions from laboratory operations
- Building 65: Emissions from thorium repackaging operations
- Building 68: Decontamination of steel rails, angle bar, and tie plates of existing railroad tracks
- Building 71\*: Emissions from material sorting and repackaging operations
- Building 78: Emissions from repackaging operations
- Other sources: Fugitive emissions from the decontamination and demolition of the Sewage Treatment Plant Complex, Waste Pit Remedial Action Project, Waste Pit 5, on-site disposal facility cell excavations/ construction, on-site disposal facility Phase 2 borrow area excavations, on-site disposal facility Phase 2 option A borrow area excavations, and various stockpiles (i.e., Fly Ash pile, southern waste units) around the FEMP site, generated via wind erosion, earth moving equipment, and material handling operations.

Note: \*Indicates 1998 point sources continuously monitored during process operations. Table D-1 provides a summary of data from point source monitors, and is included as supporting documentation and is not used to demonstrate 40 CFR 61.92 compliance.

All monitored stacks are equipped with a high efficiency particulate air (HEPA) filter used for effluent controls. HEPA filters are 99.97 percent efficient for particles of 0.3 microns or larger. Additionally, HEPA filtration systems are utilized throughout the FEMP in adhering to the As Low As Reasonably Achievable (ALARA) philosophy. In accordance with 40 CFR 61.94 (b)(5), some examples of HEPA used at the FEMP include: vacuum cleaner exhaust controls, negative pressure ventilation controls, venting glove bags and glove boxes, and in general decontamination efforts. Table D-2 is provided to comply with 40 CFR 61.94 (b)(6) which provides the distance from the points of release to the nearest residence, etc. This table is not used to demonstrate compliance with 40 CFR 61.92.

**C. Radiological Air Particulate Monitoring Program Description**

The FEMP's radiological air monitoring program is defined in the Integrated Environmental Monitoring Plan (IEMP) (DOE 1997a). The program design, as approved by the EPA, is summarized below:

**Monitoring Equipment and Locations**

- A network of 18 high volume environmental air samplers comprise the FEMP's radiological air particulate monitoring program. The monitors draw air continuously through an 8" × 10" filter at a rate of 40-50 cfm. The AMS contain a flow-rate chart recorder and an hour-meter which provides a record of the monitors operational run-time over the sampling period. Additionally, the samplers are equipped with a flow controller which maintains a constant air flow through the sampler by an electronic probe which automatically adjusts blower/motor speed to correct for variations in line voltage, temperature, pressure, or filter loading.
- The 18 air monitoring stations are divided among on site and background monitoring locations. Sixteen monitors are located on the FEMP fenceline corresponding to the 16 windrose sectors. Two monitors serve as background monitors, located in the predominant upwind directions of the Northwest (3.2 miles from the center of the FEMP) and the Southwest (6.2 miles from the center of the FEMP). The EPA siting criteria (40 CFR 58, Appendix E) were considered when selecting these locations (refer to Figure D-1 for monitoring locations).



Analytical Regime and Sampling Frequency

The analytical regime and sampling frequency for this program was designed to account for the major contributors to dose as defined in 40 CFR 61.93(b)(5)(ii) for the purpose of demonstrating NESHAP Subpart H compliance.

- Filters are exchanged on a biweekly basis and analyzed for total uranium and total particulates. These data are used to track site emissions routinely throughout the year to ensure emission controls at the FEMP are operating effectively.
- A portion of each biweekly filter is retained and is used to form a quarterly composite sample. The composite sample is analyzed for the radionuclides expected to be the major contributors to dose from site emissions. The results of the quarterly data are used to track compliance against the NESHAP Subpart H standard during the year and for demonstrating compliance at the end of the year.

Isotopes which comprise the quarterly composite analysis were selected based on the following considerations:

- Radionuclides which are stored in large quantities at the FEMP and which will be handled or processed during the remediation effort (uranium, thorium-230, thorium-232, and radium-226)
- Radionuclides which have been the major contributors to dose based on environmental and stack filter measurements (uranium)
- Radionuclides which, due to their concentrations in waste and contaminated soil, will be the major contributors to dose (uranium, thorium-228, and thorium-230).

Uranium-238, thorium-232, and uranium-235 are initial radionuclides in the uranium, thorium, and actinide decay chains, respectively. The majority of uranium and thorium received and processed during the production era of the FEMP had been separated from its decay chain progeny prior to shipment to the FEMP. As a result, decay chain progeny products were not in equilibrium with the parent concentrations. Therefore, a number of progeny radionuclides can conservatively be considered to be present in equilibrium concentrations with their parents. These radionuclides (thorium-234, radium-228, actinium-228, radium-224, and thorium-231) are considered to be in equilibrium with their parent concentrations as measured in the quarterly composites. (Refer to Table D-3 for measured net air concentrations.)

### Air Emission Data Reporting

In addition to this report, the biweekly and quarterly composite data associated with this program were tracked and reported to the EPA through IEMP quarterly status reports during 1998. In conjunction with the quarterly reports, all monitoring data were provided to the EPA via electronic media (data disc or CD-ROM) on a quarterly basis.

## SECTION II: AIR EMISSIONS DATA

### A. Air Monitoring Data Completeness Requirements

During 1998 operational AMS run-time averaged 98.7 percent for the 18 monitors. In general, interruptions in monitor operations that were encountered during 1998 were the result of power failures and/or equipment failures (refer to Table D-4). Other issues effecting data recovery and completeness are summarized below:

- AMS-24 and AMS-25 were modified during the year in an attempt to reduce ambient noise levels in consideration of FEMP stakeholders. The modification consisted of placing rubber mats on the fence around the monitor in order to dampen the noise from the air sampler motor. During a routine field inspection, the EPA determined the modification was unacceptable. The matting had been in place approximately three months. In a letter from the EPA dated December 7, 1998 (EPA 1998) (regarding unauthorized modifications to the two air monitoring stations) EPA stated that the data from the two monitors could not be used for the NESHAP Subpart H compliance demonstration based on the potential impact of the matting on the air monitors operation. Eliminating the AMS-24 and AMS-25 data will not adversely affect the compliance demonstration for the site because these monitors are located primarily upwind of FEMP remediation activities. Figure D-2 contains the 1998 wind rose data at the 10-meter height.
- An unusually high radium-226 analytical result for the third quarter of 1998 was detected at background monitor AMS-16. This data point was rejected because it was not considered reasonable based on historical background radium-226 levels. The use of this unusually high background data would have created a low bias in the net fenceline radium-226 results.
- During the data review and validation process, the following fourth quarter 1998 data were rejected based on performance problems with the off-site laboratory:

AMS-2: Isotopic thorium (thorium 228, thorium-230, and thorium-232) data were rejected due to low chemical recoveries.

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- AMS-8A: Isotopic thorium data were rejected due to low chemical recoveries.
- AMS-12: Isotopic uranium (uranium-234, uranium-235/236, and uranium-238) and isotopic thorium data from this background monitor were rejected due to low chemical recoveries.

The effect of rejecting the thorium data from AMS-2 and AMS-8A on the NESHAP compliance demonstration was evaluated. The rejected data were found to have a minimal influence on the compliance demonstration for the following reasons:

- Fourth quarter thorium data at other monitoring locations were consistent with thorium results from the first three quarters of 1998. No significant increase in thorium emissions was detected during the fourth quarter at any other fenceline monitors.
- There were no significant changes in remediation activities conducted during the fourth quarter of 1998 that involved moving, repackaging, or processing thorium wastes.
- Based on 1998 and historical measurements, thorium does not contribute the majority of dose at the fenceline monitors and therefore would not be expected to be a major component of dose at AMS-2 or AMS-8A.
- If the maximum thorium levels measured at AMS-2 or AMS-8A in any of the first three quarters of 1998 were substituted for the (rejected) fourth quarter data, the location (AMS-9C) and value (0.26 mrem) of the maximum dose at the fenceline is unchanged.

The rejection of uranium and thorium data from background monitor AMS-12 does not impact the compliance demonstration because acceptable isotopic uranium and isotopic thorium background data were obtained at AMS-16 during the fourth quarter of 1998.

The maximum air inhalation effective dose equivalent was from AMS-9C, which was not affected by rejected data and therefore does not affect the FEMP's demonstration of NESHAP compliance.

### SECTION III: DOSE ASSESSMENT

Based on the sum of the quarterly isotopic results and annual air volumes, the net measured concentrations for each radionuclide were calculated at each fenceline air monitor to determine annual average concentrations. The annual averages are compared to the values listed in Subpart H of 40 CFR 61, Appendix E, Table 2. (Refer to Table D-5 for the annual NESHAP compliance ratio report.)

At each fenceline air monitor, the sum of the fractions obtained by dividing each radionuclide concentration by the listed 40 CFR 61, Appendix E, Table 2 value was determined. The maximum value of the sum of the fractions was 0.026 and occurred at AMS-9C. AMS-9C operated 98.4 percent of the time during 1998 and no data from the monitor were rejected during the data validation process.

Assuming the values in 40 CFR 61, Appendix E, Table 2 represent the radionuclide concentration which correspond to a 10 mrem annual effective dose equivalent, the sum of the fractions at each monitor was converted to dose by multiplying the sum by 10. Using this assumption, the maximum effective dose equivalent at the fenceline (AMS-9C) is estimated to be 0.26 mrem (2.6E-03 mSv). Recognizing that the nearest residence is located approximately 2000 feet downwind from AMS-9C, the actual dose received by this receptor would be substantially lower than 0.26 mrem.

#### SECTION IV: COMPLIANCE ASSESSMENT

For 1998 the maximum effective dose equivalent from emissions of radionuclides to the ambient air, based on radionuclide measurements at the FEMP fenceline, is estimated to be 0.26 mrem (2.6E-03 mSv), which is in compliance with the Subpart H standard of 10 mrem.

#### SECTION V: ADDITIONAL INFORMATION

##### A. Meteorological Data

Refer to Figure D-2 for 1998 wind rose data.

##### B. Construction/Modifications at the FEMP

Three projects were completed in 1998 for which the requirements to apply to the EPA for approval to construct or modify were waived due to the provisions of 40 CFR 61.96. These projects were:

- Sewage treatment plant above-grade decontamination and dismantlement project.
- Building 68 decontamination of structural steel (steel rails, angle bars, and tie plates of existing railroad track)
- Plant 8 demonstration of shot blasting techniques to remove surface layers of contaminated floors.

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Refer to Appendix D.1 for CAP88-PC computer model runs as supporting documentation for the waivers.

C. Unplanned Releases of Radionuclides

For 1998 no unplanned releases of radionuclides were identified in a review of the 347 notifications received by the site's release evaluators.

**TABLE D-1**  
**NESHAP STACK EMISSIONS MONITORING RESULTS**

1998 Annual Results		
Stack Location/ Analysis Performed	Number of Samples, (Including Rinsate)	Total Pounds
<b>Building 71 Stack</b>		
Uranium, Total	5	1.3E-05
Thorium-232	5	8.6E-05
Thorium-230	5	1.2E-09
<b>Total Particulate</b>	<b>5</b>	<b>7.2E-02</b>
<b>Laboratory Stack</b>		
Uranium, Total	5	1.0E-04
Thorium-232	5	4.2E-04
Thorium-230	5	5.1E-09
<b>Total Particulate</b>	<b>5</b>	<b>1.2E+00</b>
<b>Laundry Stack</b>		
Uranium, Total	10	7.0E-06
Thorium-232	10	4.5E-04
Thorium-230	10	5.8E-09
<b>Total Particulate</b>	<b>10</b>	<b>1.1E+00</b>
<b>T-Hopper Stack</b>		
Uranium, Total	6	5.9E-04
Thorium-232	6	4.5E-04
Thorium-230	6	5.2E-09
<b>Total Particulate</b>	<b>6</b>	<b>8.0E-01</b>

**TABLE D-2<sup>a</sup>**  
**DISTANCE AND DIRECTION FROM POINTS OF RELEASE TO RECEPTORS**

Source	Type of Control	Percent Efficiency <sup>b</sup>	Dist. and Direction to Nearest Off Site Receptor
Plant 6	HEPA	99.97	854m ESE
Plant 9	None	NA	959m ESE
Building 11			
Laundry Dryer Exhaust	HEPA	99.97	1016m WSW
Respirator Washing Facility	HEPA	99.97	1017m WSW
Building 15			
Perchloric Stacks	None	NA	921m WSW
HEPA Exhaust	HEPA	99.97	921m WSW
General Exhaust	None	NA	921m WSW
Building 51	None	NA	671m W
Building 53	None	NA	939m ESE
Building 65	HEPA	99.97	844m N
Building 71	HEPA	99.97	944m N
Building 78	HEPA	99.97	833m N

<sup>a</sup>Table D-2 is included to comply with 40 CFR 61.94 (b)(6) and not used to demonstrate compliance with 40 CFR 61.92.

<sup>b</sup>NA = not applicable

**TABLE D-3**  
**NET AIR CONCENTRATIONS<sup>a</sup>**

Location	Uranium (pCi/m <sup>3</sup> )			Thorium (pCi/m <sup>3</sup> )			Radium (pCi/m <sup>3</sup> )
	234	235/236	238	228	230	232	226
<b>Fenceline</b>							
AMS-2	2.9E-05	1.7E-05	3.4E-05	0.0E+00	0.0E+00	0.0E+00	2.6E-06
AMS-3	8.4E-05	7.4E-06	8.3E-05	0.0E+00	7.9E-07	2.4E-07	9.0E-06
AMS-4	5.0E-06	0.0E+00	7.3E-06	0.0E+00	0.0E+00	0.0E+00	2.9E-06
AMS-5	1.2E-05	4.5E-06	1.3E-05	0.0E+00	0.0E+00	0.0E+00	2.2E-06
AMS-6	1.4E-05	2.0E-06	1.5E-05	0.0E+00	0.0E+00	0.0E+00	3.4E-06
AMS-7	1.0E-05	1.4E-06	1.0E-05	0.0E+00	0.0E+00	0.0E+00	4.1E-06
AMS-8A	6.2E-05	6.9E-06	6.1E-05	0.0E+00	0.0E+00	0.0E+00	3.7E-06
AMS-9C	7.0E-05	1.3E-05	7.5E-05	3.5E-06	1.6E-06	2.6E-06	0.0E+00
AMS-22	1.0E-05	3.7E-06	1.3E-05	0.0E+00	0.0E+00	0.0E+00	3.1E-06
AMS-23	1.9E-05	5.1E-06	2.3E-05	0.0E+00	0.0E+00	0.0E+00	2.0E-06
AMS-24	7.9E-06	1.2E-06	8.3E-06	0.0E+00	1.8E-06	6.8E-07	0.0E+00
AMS-25	7.8E-06	3.2E-06	7.5E-06	0.0E+00	1.5E-05	1.5E-06	3.1E-06
AMS-26	1.5E-05	4.6E-06	1.7E-05	0.0E+00	0.0E+00	0.0E+00	2.1E-06
AMS-27	6.8E-06	1.5E-06	7.6E-06	0.0E+00	0.0E+00	0.0E+00	4.7E-06
AMS-28	2.5E-06	9.5E-07	3.9E-06	0.0E+00	0.0E+00	0.0E+00	1.1E-06
AMS-29	1.5E-05	2.1E-06	1.7E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00
<b>Background</b>							
AMS-12	9.0E-06	4.7E-07	9.7E-06	5.3E-06	5.8E-06	4.8E-06	6.3E-06
AMS-16	1.6E-05	2.7E-07	1.5E-05	1.4E-05	1.7E-05	1.2E-05	5.1E-06

<sup>a</sup>Thorium-234, radium-228, actinium-228, radium-224, and thorium-231 are considered to be in equilibrium with their parent concentrations (i.e., uranium-238 pCi/m<sup>3</sup> = thorium-234 pCi/m<sup>3</sup>, thorium-232 pCi/m<sup>3</sup> = radium-228, actinium-228, and radium-224 pCi/m<sup>3</sup>, uranium-235 pCi/m<sup>3</sup> = thorium-231 pCi/m<sup>3</sup>).

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**TABLE D-4**  
**OPERATIONAL SUMMARY FOR AIR PARTICULATE MONITORING STATIONS IN 1998**

Location	Number of Samples	Sample Start Date	Last Sample Collection Date	Operating Time (hours) <sup>a</sup>	Percent of Operation
<b>Fenceline</b>					
AMS-2	26	12/30/97	12/29/98	8634	98.8
AMS-3	26	12/30/97	12/29/98	8483	97.1
AMS-4	26	12/30/97	12/29/98	8610	98.6
AMS-5	26	12/30/97	12/29/98	8734	100
AMS-6	26	12/30/97	12/29/98	8627	98.7
AMS-7	26	12/30/97	12/29/98	8704	99.6
AMS-8A	26	12/30/97	12/29/98	8666	99.2
AMS-9C	26	12/30/97	12/29/98	8597	98.4
AMS-22	26	12/30/97	12/29/98	8674	99.3
AMS-23	26	12/30/97	12/29/98	8669	99.2
AMS-24	26	12/30/97	12/29/98	8591	98.3
AMS-25	26	12/30/97	12/29/98	8506	97.4
AMS-26	26	12/30/97	12/29/98	8719	99.8
AMS-27	25	12/30/97	12/29/98	8313	95.2
AMS-28	26	12/30/97	12/29/98	8713	99.7
AMS-29	26	12/30/97	12/29/98	8685	99.4
<b>Background</b>					
AMS-12	26	12/30/97	12/29/98	8599	98.4
AMS-16	26	12/30/97	12/29/98	8609	98.5

<sup>a</sup>8736 available operating hours from December 30, 1997 through December 29, 1998

**TABLE D-5**  
**ANNUAL NESHAP COMPLIANCE RATIO REPORT**

40 CFR 61 (NESHAP) Subpart H Appendix E, Table 2; Net Ratios <sup>a</sup>														
Location	Actinium-228 <sup>b</sup>	Radium-224 <sup>b</sup>	Radium-226	Radium-228 <sup>b</sup>	Thorium-228	Thorium-230	Thorium-231 <sup>b</sup>	Thorium-232	Thorium-234 <sup>b</sup>	Uranium-235	Uranium-236	Uranium-238	Ratio Totals	Dose <sup>c</sup> (mrem)
<b>Fenceline</b>														
AMS-2	0.0E+00	0.0E+00	7.9E-04	0.0E+00	0.0E+00 <sup>d</sup>	0.0E+00 <sup>d</sup>	5.8E-08	0.0E+00 <sup>d</sup>	1.5E-05	3.8E-03	2.3E-03	4.1E-03	1.1E-02	.109
AMS-3	6.6E-08	1.6E-06	2.7E-03	4.2E-05	0.0E+00	2.3E-04	2.5E-08	4.0E-04	3.8E-05	1.1E-02	1.0E-03	1.0E-02	2.5E-02	.254
AMS-4	0.0E+00	0.0E+00	8.8E-04	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.3E-06	6.5E-04	0.0E+00	8.8E-04	2.4E-03	.024
AMS-5	0.0E+00	0.0E+00	6.6E-04	0.0E+00	0.0E+00	0.0E+00	1.5E-08	0.0E+00	5.7E-06	1.6E-03	6.0E-04	1.5E-03	4.4E-03	.044
AMS-6	0.0E+00	0.0E+00	1.0E-03	0.0E+00	0.0E+00	0.0E+00	6.9E-09	0.0E+00	7.0E-06	1.9E-03	2.7E-04	1.9E-03	5.0E-03	.050
AMS-7	8.5E-09	0.0E+00	1.2E-03	0.0E+00	0.0E+00	0.0E+00	4.9E-09	0.0E+00	4.6E-06	1.3E-03	1.9E-04	1.2E-03	4.0E-03	.040
AMS-8A	0.0E+00	0.0E+00	1.1E-03	0.0E+00	0.0E+00 <sup>e</sup>	0.0E+00	2.4E-08	0.0E+00 <sup>e</sup>	2.8E-05	8.1E-03	9.3E-04	7.3E-03	1.7E-02	.175
AMS-9C	7.0E-07	1.7E-05	0.0E+00	4.4E-04	1.3E-03	4.8E-04	4.4E-08	4.2E-03	3.4E-05	9.1E-03	1.7E-03	9.0E-03	2.6E-02	.261
AMS-22	0.0E+00	0.0E+00	9.3E-04	0.0E+00	0.0E+00	0.0E+00	1.3E-08	0.0E+00	5.1E-06	1.3E-04	5.0E-04	1.5E-03	4.2E-03	.042
AMS-23	0.0E+00	0.0E+00	6.2E-04	0.0E+00	0.0E+00	0.0E+00	1.8E-08	0.0E+00	1.0E-05	2.5E-03	6.9E-04	2.7E-03	6.5E-03	.065
AMS-24 <sup>e</sup>	1.8E-07	4.5E-06	0.0E+00	1.2E-04	2.3E-04	5.3E-04	4.0E-09	1.1E-03	3.8E-06	1.0E-04	1.6E-04	9.9E-04	3.9E-03	.039
AMS-25 <sup>e</sup>	3.9E-07	9.7E-05	9.3E-04	2.5E-04	3.7E-04	4.4E-03	1.1E-08	2.3E-03	3.4E-06	1.0E-04	4.3E-04	9.0E-04	1.0E-02	.102
AMS-26	0.0E+00	0.0E+00	6.5E-04	0.0E+00	0.0E+00	0.0E+00	1.6E-08	0.0E+00	7.8E-06	2.0E-03	6.3E-04	2.1E-03	5.3E-03	.053
AMS-27	0.0E+00	0.0E+00	1.4E-03	0.0E+00	0.0E+00	0.0E+00	5.1E-09	0.0E+00	3.5E-06	8.8E-04	2.0E-04	9.1E-04	3.4E-03	.034
AMS-28	0.0E+00	0.0E+00	3.4E-04	0.0E+00	0.0E+00	0.0E+00	3.3E-09	0.0E+00	1.8E-06	3.3E-04	1.3E-05	4.6E-04	1.3E-03	.013
AMS-29	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.2E-09	0.0E+00	7.9E-06	1.9E-03	2.8E-04	2.1E-03	4.3E-03	.043
<b>Background</b>														
AMS-12	1.3E-06	3.2E-05	1.9E-03	8.1E-04	1.7E-03 <sup>d</sup>	1.7E-03 <sup>d</sup>	1.6E-09	7.7E-03 <sup>d</sup>	4.4E-06	1.2E-03 <sup>d</sup>	6.4E-05 <sup>d</sup>	1.2E-03 <sup>d</sup>	NA <sup>f</sup>	
AMS-16	3.2E-06	7.8E-05	1.5E-03 <sup>g</sup>	2.0E-03	4.7E-03	4.9E-03	9.4E-10	1.9E-02	7.0E-06	2.0E-03	3.7E-05	1.9E-03	NA <sup>f</sup>	

Maximum Year-to-Date Ratio: 0.026 Maximum Year-to-Date Dose (mrem): 0.261

<sup>a</sup>A ratio of 0.0+00 indicates the filter results were less than or equal to the blank results, and/or the indicator concentrations were less than or equal to the average net background concentrations.

<sup>b</sup>Isotopes assumed to be in equilibrium with their parents.

<sup>c</sup>Dose conversions are based on the NESHAP standard of 10 mrem per year.

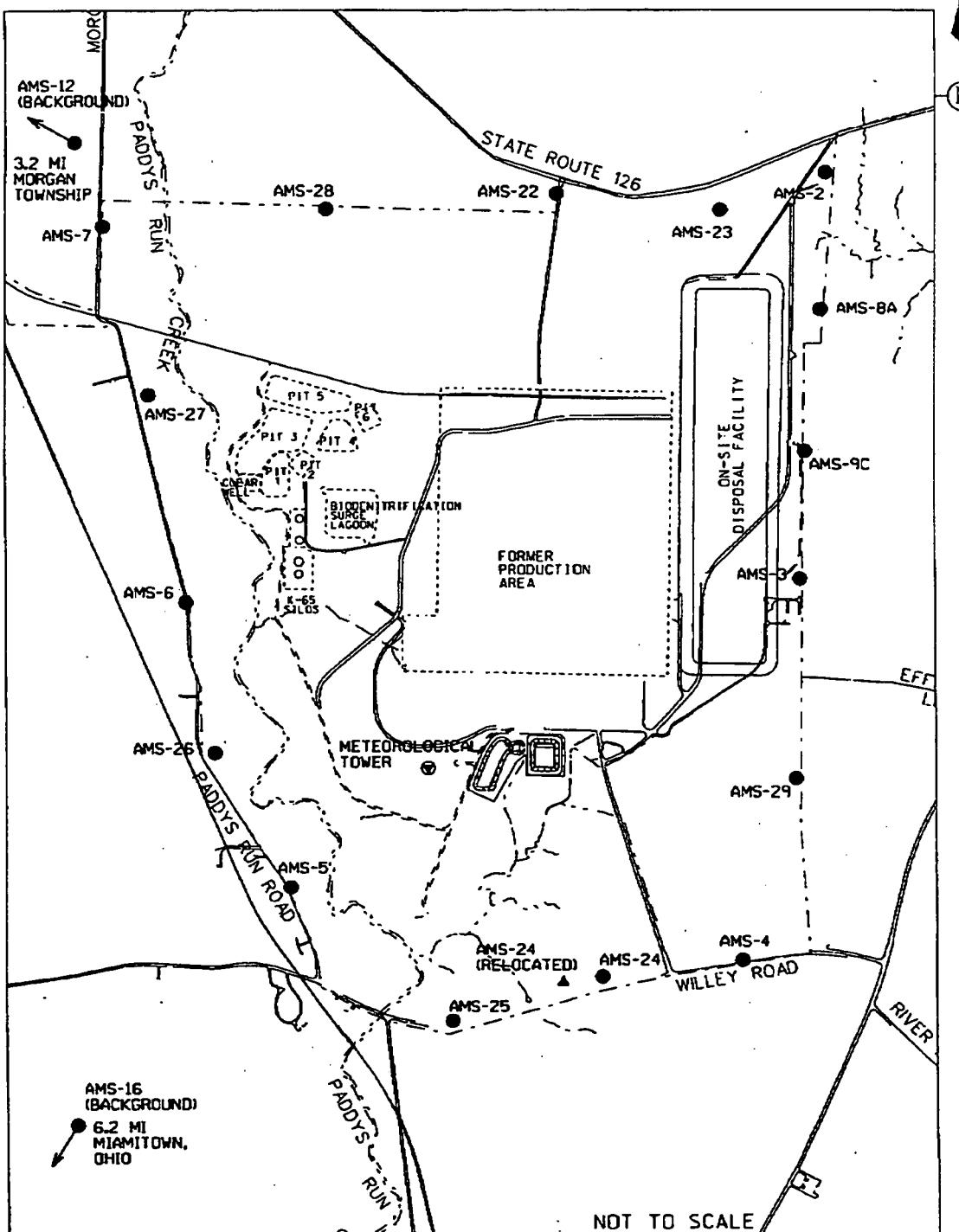
<sup>d</sup>Through the validation process, fourth quarter data were rejected due to low tracer recoveries. Rejected data were not used in dose calculations.

<sup>e</sup>Suspect data due to inflow disturbances caused by sound reduction matts.

<sup>f</sup>NA = not applicable

<sup>g</sup>The validated third quarter result was not considered representative of true background radium-226 concentrations at AMS-16. Therefore, the result was not used in dose calculations.

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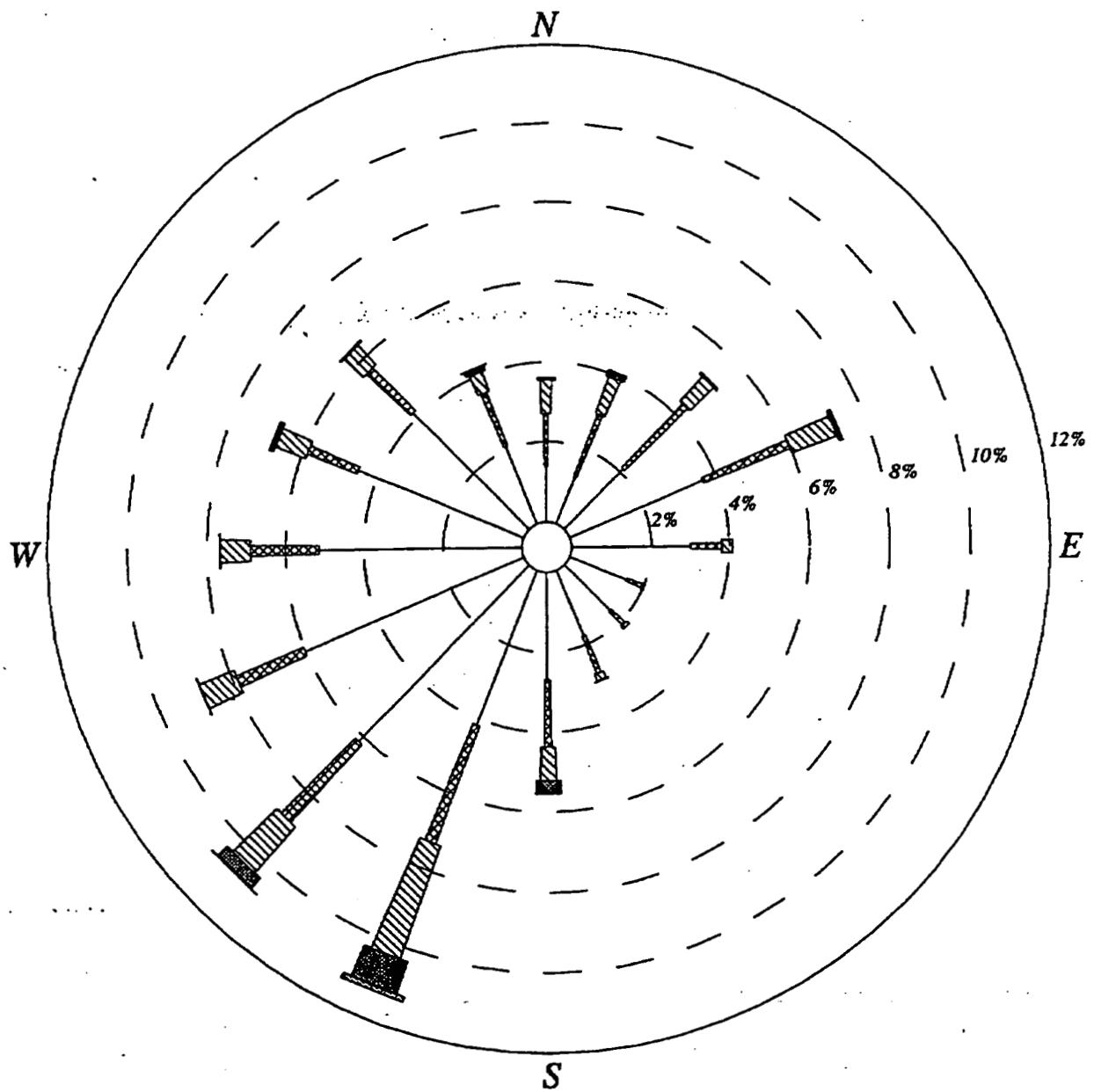


**LEGEND:**

- FEMP BOUNDARY  
● AMS LOCATION  
▲ AMS-24 RELOCATED  
330 FEET EAST

DISTANCE FROM CENTER OF  
FORMER PRODUCTION AREA  
TO AMS LOCATION OFF MAP

## FIGURE D-1 RADIOLOGICAL AIR MONITORING STATION LOCATIONS



**CALM WINDS 6.97%**

**WIND SPEED (KNOTS)**

*NOTE: Frequencies  
indicate direction  
from which the  
wind is blowing.*

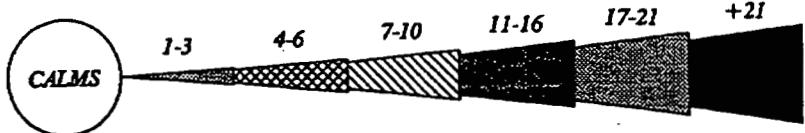


FIGURE D-16 1998 WIND ROSE DATA, 10-METER HEIGHT

**REFERENCES**

U.S. Dept. of Energy, 1997a, "Integrated Environmental Monitoring Plan," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1997b, DOE-0980-97, Johnny Reising to James Saric and Michael Murphy, "Application for Approval to Use Environmental Measurements to Demonstrate Compliance with the National Emission Standards for Hazardous Air Pollutants Subpart H, "dated May 23, 1997.

U.S. Environmental Protection Agency, 1998, U.S. EPA, Michael Murphy to Johnny Reising, "DOE-0082-99; "Response to Issues Regarding National Emission Standards for Hazardous Air Pollutants Air Monitoring Stations," dated December 7, 1998.

U.S. Environmental Protection Agency, 1997, Jack Barnett to Johnny Reising, "Application for Approval to Use Environmental Measurements to Demonstrate Compliance with the National Emission Standards for Hazardous Air Pollutants Subpart H," dated August 11, 1997.

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FEMP-ISER-98-FINAL  
Appendix D, Revision 0  
May 28, 1999

**SECTION VI: CERTIFICATION**

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment. (see 18 U.S.C. 1001).

Name: Jahr Crag

Signature: [Signature] Date: 5/27/99

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**ATTACHMENT D.1**

**CAP88-PC COMPUTER MODEL RUNS AS  
SUPPORTING DOCUMENTATION FOR 40 CFR 61.96**

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**SEWER TREATMENT FACILITY - 39D**

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**SEWER TREATMENT FACILITY- 39D**  
**ESTIMATION OF EMISSIONS (FIXED + REMOVABLE) DURING DISMANTLING**

**ASSUMPTIONS:**

- 1) Uranium is the only radionuclide present
- 2) All contamination is 1.25% enriched which is the highest routine enrichment processed during production of uranium metal.
- 3) Fixed + removable contamination will become airborned during dismantling/demolition activities.
- 4) Total area of building equals:
 

floor: 60 ft x 15 ft or 18.3 m x 4.6 m = 84.2 m<sup>2</sup>  
 2 walls: 2(60 ft x 15 ft) or 2(84.2 m<sup>2</sup>) = 168.4 m<sup>2</sup>  
 2 walls: 2(15 ft x 15 ft) or 2(21.2 m<sup>2</sup>) = 42.4 m<sup>2</sup>  
 Total: 295 m<sup>2</sup> or 2,950,000 cm<sup>2</sup>
- 5) Contamination is based on the radiological surveys done by technicians
- 6) Uranium contamination is released into the environment via a 2000 cfm HEPA filtration unit with a exit vent of 1 ft x 1 ft or 1 ft<sup>2</sup>.
- 7) One-tenth of 1% of uranium contamination will be emitted into the environment during dismantling/demolition activities. (Conservative estimate based on 40 CFR 61 Appendix D)

Note: The survey report included beta-gamma dpm of loose (removable) contamination and beta-gamma of fixed + removable contamination. For estimating emissions from Building 39D, the maximum value of fixed + removable contamination was used. This is the most conservative estimate.

<u>ISOTOPE</u>	<u>ASSAY %</u>	<u>HALF-LIFE (YRS)</u>	<u>LAMBDA <math>\lambda</math>, sec<sup>-1</sup></u>
U-234	0.019%	2.45 E5	8.97 E-14
U-235	1.25%	7.04 E8	3.12 E-17
U-238	98.73%	4.47 E9	4.92 E-18

Lambda ( $\lambda$ ) is the decay constant and equals 0.6931/half-life.

$$\text{Activity, } A = \lambda N * (\% \text{Assay}/100)$$

$$A = \text{dps}$$

$$\lambda = 1/\text{sec}$$

$$N = \text{atoms} = \text{total grams of uranium} * 1 \text{ g mole}/238 \text{ g} * 6.023 \text{ E}23 \text{ atoms/g mole}$$

$$A_{\text{U-234}} = 8.97 \text{ E-14} * (0.00019 * N) = 43,130 * \text{total U g}$$

$$A_{\text{U-235}} = 3.12 \text{ E-17} * (0.0125 * N) = 987 * \text{total U g}$$

$$A_{\text{U-238}} = 4.92 \text{ E-18} * (0.9873 * N) = 12,293 * \text{total U g}$$

$$A_{\text{U-total}} (\text{dps}) = (43,130 + 987 + 12,293) * \text{total U g} = 56,410 \text{ atoms/sec g} * \text{total U g}$$

$$A_{\text{U-total}} (\text{dpm}) = 3,384,600 \text{ atoms/min g} * \text{total U g}$$

ALSO:

$$A_{U\text{-total}} \text{ (dpm)} = (\text{maximum survey values}/100\text{cm}^2) * (\text{surface area}/100) 100 \text{ cm}^2$$

$$A_{U\text{-total}} \text{ (dpm)} = 2,400,000 \text{ dpm}/100 \text{ cm}^2 * 29,500 100 \text{ cm}^2 = 7.08 \text{ E}10 \text{ dpm}$$

THEREFORE:

$$3,384,600 \text{ atoms/min g} * \text{total U grams} = 7.08 \text{ E}10 \text{ dpm}$$

$$\text{total U grams} = 7.08 \text{ E}10 \text{ dpm} / 3,384,600 \text{ atoms/min g}$$

$$\text{total U grams} = 20,918.3 \text{ total U grams}$$

#### ESTIMATED OF URANIUM ACTIVITY:

<u>ISOTOPE</u>	<u>MASS, g</u>	<u>ACTIVITY, pCi/<math>\mu</math>g</u>	<u>ACTIVITIY, Ci</u>
U-234	3.97	6246.1	0.0248
U-235	261.5	2.161	5.65 E-4
U-238	20,652.6	0.336	6.94 E-3

#### ESTIMATED OF EMISSIONS:

$$\text{U-234: } 0.1(0.01) * 0.0248 = 2.48 \text{ E-5 Ci}$$

$$\text{U-235: } 0.1(0.01) * 5.65 \text{ E-4} = 5.65 \text{ E-7 Ci}$$

$$\text{U-238: } 0.1(0.01) * 6.94 \text{ E-3} = 6.94 \text{ E-6 Ci}$$

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C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S   R E P O R T

Non-Radon Individual Assessment  
Feb 18, 1998 1:21 pm

Facility: FERNALD ENVIRONMENT MANAGEMENT PROJECT  
Address: P.O. BOX 538704  
7400 WILLEY ROAD  
City: CINCINNATI  
State: OH Zip: 45253-8704

Effective Dose Equivalent  
(mrem/year)

2.03E-03

At This Location: 714 Meters North Northeast

Source Category: STACK  
Source Type: Stack  
Emission Year: 1997

Comments: OFFSITE EDE FROM DISMANTLING/DEMOLITION OF SEWER  
TREATMENT FACILITY- 39D - FIXED+REMOVABLE

Dataset Name: SEWERTREAT3  
Dataset Date: Feb 18, 1998 1:21 pm  
Wind File: WNDFILES\FEMPSTD.WND

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Feb 18, 1998 1:21 pm

SYNOPSIS  
Page 1

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 714 Meters North Northeast  
Lifetime Fatal Cancer Risk: 2.63E-08

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	5.36E-06
BREAST	6.22E-06
R MAR	1.19E-04
LUNGS	1.60E-02
THYROID	5.22E-06
ENDOST	1.79E-03
RMNDR	1.56E-04
EFFEC	2.03E-03

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Feb 18, 1998 1:21 pm

SYNOPSIS  
Page 2

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source	
			#1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	2.5E-05	2.5E-05
U-235	Y	1.00	5.6E-07	5.6E-07
U-238	Y	1.00	6.9E-06	6.9E-06

SITE INFORMATION

Temperature: 12 degrees C  
Precipitation: 102 cm/y  
Mixing Height: 950 m

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Feb 18, 1998 1:21 pm

SYNOPSIS  
Page 3

SOURCE INFORMATION

Source Number: 1

Stack Height (m): 1.00  
Diameter (m): 0.34

Plume Rise  
Momentum (m/s): 1.02E+01  
(Exit Velocity)

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.  
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1308	1323	2244	1975	1714	1435	1437	1446	1470	1550
1528	1435	1238	1203	1670	1099	731	714	1369	1483

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C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E   A N D   R I S K   E Q U I V A L E N T   S U M M A R I E S

Non-Radon Individual Assessment  
Feb 18, 1998 1:21 pm

Facility: FERNALD ENVIRONMENT MANAGEMENT PROJECT  
Address: P.O. BOX 538704  
7400 WILLEY ROAD  
City: CINCINNATI  
State: OH Zip: 45253-8704

Source Category: STACK  
Source Type: Stack  
Emission Year: 1997

Comments: OFFSITE EDE FROM DISMANTLING/DEMOLITION OF SEWER  
TREATMENT FACILITY- 39D - FIXED+REMOVABLE (1/10 OF 1%  
RELEASED INTO THE ENVIRONMENT)

Dataset Name: SEWERTREAT3  
Dataset Date: Feb 18, 1998 1:21 pm  
Wind File: WNDFILES\FEMPSTD.WND

F:\WPW61\SEWTREAT\E.SUM

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Feb 18, 1998 1:21 pm

SUMMARY  
Page 1

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	5.36E-06
BREAST	6.22E-06
R MAR	1.19E-04
LUNGS	1.60E-02
THYROID	5.22E-06
ENDOST	1.79E-03
RMNDR	1.56E-04
EFFEC	2.03E-03

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.13E-04
INHALATION	1.92E-03
AIR IMMERSION	2.56E-11
GROUND SURFACE	9.79E-07
INTERNAL	2.03E-03
EXTERNAL	9.79E-07
TOTAL	2.04E-03

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SUMMARY  
Page 2

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	1.60E-03
U-235	3.46E-05
U-238	3.99E-04
TOTAL	2.04E-03

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SUMMARY  
Page 3

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	1.25E-10
BONE	9.46E-11
THYROID	1.17E-12
BREAST	1.38E-11
LUNG	2.56E-08
STOMACH	7.83E-12
BOWEL	1.04E-11
LIVER	7.58E-12
PANCREAS	5.20E-12
URINARY	3.38E-10
OTHER	6.36E-12
TOTAL	2.63E-08

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	5.80E-10
INHALATION	2.57E-08
AIR IMMERSION	5.96E-16
GROUND SURFACE	2.24E-11
INTERNAL	2.62E-08
EXTERNAL	2.24E-11
TOTAL	2.63E-08

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SUMMARY  
Page 4

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	2.06E-08
U-235	4.55E-10
U-238	5.18E-09
TOTAL	2.63E-08

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Feb 18, 1998 1:21 pm

SUMMARY  
Page 5INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)  
(All Radionuclides and Pathways)

Direction	Distance (m)						
	1308	1323	2244	1975	1714	1435	1437
N	3.5E-04	3.4E-04	1.5E-04	1.8E-04	2.3E-04	3.0E-04	3.0E-04
NNW	1.5E-04	1.5E-04	6.6E-05	8.0E-05	9.9E-05	1.3E-04	1.3E-04
NW	1.3E-04	1.3E-04	5.9E-05	7.1E-05	8.8E-05	1.1E-04	1.1E-04
WNW	1.1E-04	1.1E-04	5.1E-05	6.1E-05	7.5E-05	9.8E-05	9.8E-05
W	1.7E-04	1.7E-04	7.4E-05	8.9E-05	1.1E-04	1.5E-04	1.5E-04
WSW	4.3E-04	4.2E-04	1.8E-04	2.2E-04	2.8E-04	3.7E-04	3.7E-04
SW	2.9E-04	2.8E-04	1.2E-04	1.5E-04	1.9E-04	2.5E-04	2.5E-04
SSW	3.7E-04	3.6E-04	1.5E-04	1.9E-04	2.4E-04	3.2E-04	3.2E-04
S	3.6E-04	3.5E-04	1.5E-04	1.8E-04	2.3E-04	3.1E-04	3.0E-04
SSE	3.4E-04	3.3E-04	1.4E-04	1.7E-04	2.2E-04	2.9E-04	2.9E-04
SE	3.3E-04	3.2E-04	1.4E-04	1.7E-04	2.1E-04	2.8E-04	2.8E-04
ESE	4.5E-04	4.4E-04	1.9E-04	2.3E-04	2.9E-04	3.9E-04	3.8E-04
E	3.2E-04	3.1E-04	1.3E-04	1.6E-04	2.0E-04	2.7E-04	2.7E-04
ENE	3.4E-04	3.3E-04	1.4E-04	1.7E-04	2.2E-04	2.9E-04	2.9E-04
NE	3.7E-04	3.7E-04	1.6E-04	1.9E-04	2.4E-04	3.2E-04	3.2E-04
NNE	7.1E-04	7.0E-04	2.9E-04	3.6E-04	4.6E-04	6.1E-04	6.1E-04

Direction	Distance (m)						
	1446	1470	1550	1528	1435	1238	1203
N	3.0E-04	2.9E-04	2.7E-04	2.7E-04	3.0E-04	3.8E-04	4.0E-04
NNW	1.3E-04	1.2E-04	1.2E-04	1.2E-04	1.3E-04	1.6E-04	1.7E-04
NW	1.1E-04	1.1E-04	1.0E-04	1.0E-04	1.1E-04	1.4E-04	1.5E-04
WNW	9.7E-05	9.5E-05	8.7E-05	8.9E-05	9.8E-05	1.2E-04	1.3E-04
W	1.4E-04	1.4E-04	1.3E-04	1.3E-04	1.5E-04	1.9E-04	1.9E-04
WSW	3.7E-04	3.6E-04	3.3E-04	3.3E-04	3.7E-04	4.7E-04	4.9E-04
SW	2.5E-04	2.4E-04	2.2E-04	2.2E-04	2.5E-04	3.2E-04	3.3E-04
SSW	3.1E-04	3.1E-04	2.8E-04	2.9E-04	3.2E-04	4.0E-04	4.2E-04
S	3.0E-04	2.9E-04	2.7E-04	2.8E-04	3.1E-04	3.9E-04	4.1E-04
SSE	2.9E-04	2.8E-04	2.5E-04	2.6E-04	2.9E-04	3.7E-04	3.9E-04
SE	2.8E-04	2.7E-04	2.5E-04	2.5E-04	2.8E-04	3.6E-04	3.8E-04
ESE	3.8E-04	3.7E-04	3.4E-04	3.5E-04	3.9E-04	4.9E-04	5.2E-04
E	2.7E-04	2.6E-04	2.4E-04	2.5E-04	2.7E-04	3.5E-04	3.6E-04

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ENE	2.9E-04	2.8E-04	2.6E-04	2.6E-04	2.9E-04	3.7E-04	3.9E-04
NE	3.2E-04	3.1E-04	2.8E-04	2.9E-04	3.2E-04	4.1E-04	4.3E-04
NNE	6.0E-04	5.9E-04	5.4E-04	5.5E-04	6.1E-04	7.8E-04	8.1E-04

Feb 18, 1998 1:21 pm

SUMMARY  
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INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)  
(All Radionuclides and Pathways)

Direction	Distance (m)					
	1670	1099	731	714	1369	1483
N	2.4E-04	4.7E-04	9.6E-04	1.0E-03	3.3E-04	2.9E-04
NNW	1.0E-04	2.0E-04	4.0E-04	4.2E-04	1.4E-04	1.2E-04
NW	9.1E-05	1.7E-04	3.5E-04	3.6E-04	1.2E-04	1.1E-04
WNW	7.8E-05	1.5E-04	3.0E-04	3.1E-04	1.1E-04	9.4E-05
W	1.2E-04	2.2E-04	4.6E-04	4.8E-04	1.6E-04	1.4E-04
WSW	2.9E-04	5.7E-04	1.2E-03	1.2E-03	4.0E-04	3.5E-04
SW	1.9E-04	3.8E-04	7.9E-04	8.2E-04	2.7E-04	2.4E-04
SSW	2.5E-04	4.9E-04	1.0E-03	1.1E-03	3.4E-04	3.0E-04
S	2.4E-04	4.7E-04	9.8E-04	1.0E-03	3.3E-04	2.9E-04
SSE	2.2E-04	4.5E-04	9.3E-04	9.8E-04	3.1E-04	2.7E-04
SE	2.2E-04	4.3E-04	8.9E-04	9.2E-04	3.0E-04	2.7E-04
ESE	3.0E-04	6.0E-04	1.2E-03	1.3E-03	4.2E-04	3.7E-04
E	2.1E-04	4.2E-04	8.6E-04	9.0E-04	2.9E-04	2.6E-04
ENE	2.3E-04	4.5E-04	9.3E-04	9.7E-04	3.1E-04	2.8E-04
NE	2.5E-04	5.0E-04	1.0E-03	1.1E-03	3.5E-04	3.0E-04
NNE	4.7E-04	9.4E-04	1.9E-03	2.0E-03	6.6E-04	5.8E-04

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SUMMARY  
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INDIVIDUAL LIFETIME RISK (deaths)  
(All Radionuclides and Pathways)

Direction	Distance (m)						
	1308	1323	2244	1975	1714	1435	1437
N	4.4E-09	4.4E-09	1.8E-09	2.2E-09	2.8E-09	3.8E-09	3.8E-09
NNW	1.9E-09	1.8E-09	7.8E-10	9.6E-10	1.2E-09	1.6E-09	1.6E-09
NW	1.6E-09	1.6E-09	6.9E-10	8.5E-10	1.1E-09	1.4E-09	1.4E-09
WNW	1.4E-09	1.4E-09	5.9E-10	7.2E-10	9.0E-10	1.2E-09	1.2E-09
W	2.1E-09	2.1E-09	8.8E-10	1.1E-09	1.4E-09	1.8E-09	1.8E-09
WSW	5.5E-09	5.4E-09	2.2E-09	2.8E-09	3.5E-09	4.7E-09	4.7E-09
SW	3.7E-09	3.6E-09	1.5E-09	1.8E-09	2.3E-09	3.1E-09	3.1E-09
SSW	4.7E-09	4.6E-09	1.9E-09	2.4E-09	3.0E-09	4.0E-09	4.0E-09
S	4.5E-09	4.4E-09	1.8E-09	2.3E-09	2.9E-09	3.9E-09	3.8E-09
SSE	4.3E-09	4.2E-09	1.7E-09	2.1E-09	2.7E-09	3.6E-09	3.6E-09
SE	4.2E-09	4.1E-09	1.7E-09	2.1E-09	2.7E-09	3.6E-09	3.6E-09
ESE	5.7E-09	5.6E-09	2.3E-09	2.9E-09	3.6E-09	4.9E-09	4.9E-09
E	4.0E-09	3.9E-09	1.6E-09	2.0E-09	2.6E-09	3.4E-09	3.4E-09
ENE	4.3E-09	4.2E-09	1.8E-09	2.2E-09	2.7E-09	3.7E-09	3.7E-09
NE	4.7E-09	4.7E-09	1.9E-09	2.4E-09	3.0E-09	4.1E-09	4.0E-09
NNE	9.1E-09	8.9E-09	3.7E-09	4.6E-09	5.8E-09	7.8E-09	7.8E-09

Direction	Distance (m)						
	1446	1470	1550	1528	1435	1238	1203
N	3.8E-09	3.7E-09	3.4E-09	3.4E-09	3.8E-09	4.9E-09	5.1E-09
NNW	1.6E-09	1.5E-09	1.4E-09	1.4E-09	1.6E-09	2.0E-09	2.1E-09
NW	1.4E-09	1.4E-09	1.2E-09	1.3E-09	1.4E-09	1.8E-09	1.9E-09
WNW	1.2E-09	1.2E-09	1.1E-09	1.1E-09	1.2E-09	1.5E-09	1.6E-09
W	1.8E-09	1.7E-09	1.6E-09	1.6E-09	1.8E-09	2.3E-09	2.4E-09
WSW	4.6E-09	4.5E-09	4.1E-09	4.2E-09	4.7E-09	6.0E-09	6.3E-09
SW	3.1E-09	3.0E-09	2.8E-09	2.8E-09	3.1E-09	4.0E-09	4.2E-09
SSW	4.0E-09	3.9E-09	3.5E-09	3.6E-09	4.0E-09	5.1E-09	5.4E-09
S	3.8E-09	3.7E-09	3.4E-09	3.5E-09	3.9E-09	4.9E-09	5.2E-09
SSE	3.6E-09	3.5E-09	3.2E-09	3.3E-09	3.6E-09	4.7E-09	4.9E-09
SE	3.5E-09	3.4E-09	3.1E-09	3.2E-09	3.6E-09	4.6E-09	4.8E-09
ESE	4.8E-09	4.7E-09	4.3E-09	4.4E-09	4.9E-09	6.3E-09	6.6E-09
E	3.4E-09	3.3E-09	3.0E-09	3.1E-09	3.4E-09	4.4E-09	4.6E-09

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ENE	3.6E-09	3.5E-09	3.2E-09	3.3E-09	3.7E-09	4.7E-09	4.9E-09
NE	4.0E-09	3.9E-09	3.6E-09	3.7E-09	4.1E-09	5.2E-09	5.5E-09
NNE	7.7E-09	7.5E-09	6.8E-09	7.0E-09	7.8E-09	1.0E-08	1.0E-08

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SUMMARY  
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INDIVIDUAL LIFETIME RISK (deaths)  
(All Radionuclides and Pathways)

Distance (m)

Direction	1670	1099	731	714	1369	1483
N	3.0E-09	5.9E-09	1.2E-08	1.3E-08	4.1E-09	3.6E-09
NNW	1.3E-09	2.5E-09	5.2E-09	5.4E-09	1.7E-09	1.5E-09
NW	1.1E-09	2.2E-09	4.5E-09	4.6E-09	1.5E-09	1.3E-09
WNW	9.4E-10	1.8E-09	3.8E-09	4.0E-09	1.3E-09	1.1E-09
W	1.4E-09	2.8E-09	5.8E-09	6.1E-09	2.0E-09	1.7E-09
WSW	3.7E-09	7.3E-09	1.5E-08	1.6E-08	5.1E-09	4.5E-09
SW	2.4E-09	4.9E-09	1.0E-08	1.1E-08	3.4E-09	3.0E-09
SSW	3.1E-09	6.3E-09	1.3E-08	1.4E-08	4.3E-09	3.8E-09
S	3.0E-09	6.0E-09	1.3E-08	1.3E-08	4.2E-09	3.6E-09
SSE	2.8E-09	5.7E-09	1.2E-08	1.3E-08	3.9E-09	3.4E-09
SE	2.8E-09	5.5E-09	1.1E-08	1.2E-08	3.9E-09	3.4E-09
ESE	3.8E-09	7.7E-09	1.6E-08	1.7E-08	5.3E-09	4.6E-09
E	2.7E-09	5.4E-09	1.1E-08	1.2E-08	3.7E-09	3.2E-09
ENE	2.9E-09	5.8E-09	1.2E-08	1.3E-08	4.0E-09	3.5E-09
NE	3.1E-09	6.4E-09	1.3E-08	1.4E-08	4.4E-09	3.8E-09
NNE	6.1E-09	1.2E-08	2.5E-08	2.6E-08	8.4E-09	7.4E-09

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C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S   R E P O R T

Non-Radon Individual Assessment

Feb 18, 1998 12:59 am

Facility: FERNALD ENVIRONMENT MANAGEMENT PROJECT

Address: P.O. BOX 538704

2264

7400 WILLEY ROAD

City: CINCINNATI

State: OH Zip: 45253-8704

Effective Dose Equivalent  
(mrem/year)

8.82E-04

At This Location: 1142 Meters North Northeast

Source Category: STACK

Source Type: Stack

Emission Year: 1997

Comments: OFFSITE EDE FROM DISMANTLING/DEMOLITION OF SEWER  
TREATMENT FACILITY- 39D PART 2- FIXED+REMOVABLE

Dataset Name: sewertreat4

Dataset Date: Feb 18, 1998 12:59 am

Wind File: WNDFILES\FEMPSTD.WND

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SYNOPSIS

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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 1142 Meters North Northeast  
Lifetime Fatal Cancer Risk: 1.14E-08

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	2.50E-06
BREAST	2.89E-06
R MAR	5.56E-05
LUNGS	6.90E-03
THYROID	2.43E-06
ENDOST	8.37E-04
RMNDR	7.28E-05
EFFEC	8.82E-04

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SYNOPSIS

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RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source	
			#1	TOTAL
U-234	Y	1.00	2.5E-05	2.5E-05
U-235	Y	1.00	5.6E-07	5.6E-07
U-238	Y	1.00	6.9E-06	6.9E-06

SITE INFORMATION

Temperature: 12 degrees C  
Precipitation: 102 cm/y  
Mixing Height: 950 m

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SYNOPSIS

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#### SOURCE INFORMATION

Source Number: 1

Stack Height (m): 1.00  
Diameter (m): 0.34

Plume Rise  
Momentum (m/s): 1.02E+01  
(Exit Velocity)

#### AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.  
Default Values used.

#### DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1215	1694	2479	1410	2112	2757	1956	1810	1142	1833
1902	1885	2817	2003	2244	2339	2299	2258	2291	1621

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C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E   A N D   R I S K   E Q U I V A L E N T   S U M M A R I E S

Non-Radon Individual Assessment  
Feb 18, 1998 12:59 am

Facility: FERNALD ENVIRONMENT MANAGEMENT PROJECT  
Address: P.O. BOX 538704  
7400 WILLEY ROAD  
City: CINCINNATI  
State: OH Zip: 45253-8704

Source Category: STACK  
Source Type: Stack  
Emission Year: 1997

Comments: OFFSITE EDE FROM DISMANTLING/DEMOLITION OF SEWER  
TREATMENT FACILITY- 39D PART 2- FIXED+REMOVABLE (1/10  
OF 1% RELEASED INTO THE ENVIRONMENT)

Dataset Name: sewertreat4  
Dataset Date: Feb 18, 1998 12:59 am  
Wind File: WNDFILES\FEMPSTD.WND

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Feb 18, 1998 12:59 am

SUMMARY  
Page 1

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	2.50E-06
BREAST	2.89E-06
R MAR	5.56E-05
LUNGS	6.90E-03
THYROID	2.43E-06
ENDOST	8.37E-04
RMNDR	7.28E-05
EFFEC	8.82E-04

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	5.28E-05
INHALATION	8.29E-04
AIR IMMERSION	1.11E-11
GROUND SURFACE	4.50E-07
INTERNAL	8.82E-04
EXTERNAL	4.50E-07
TOTAL	8.83E-04

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SUMMARY  
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NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	6.95E-04
U-235	1.50E-05
U-238	1.73E-04
TOTAL	8.83E-04

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SUMMARY  
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CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	5.84E-11
BONE	4.42E-11
THYROID	5.41E-13
BREAST	6.39E-12
LUNG	1.11E-08
STOMACH	3.64E-12
BOWEL	4.83E-12
LIVER	3.52E-12
PANCREAS	2.42E-12
URINARY	1.58E-10
OTHER	2.96E-12
TOTAL	1.14E-08

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	2.71E-10
INHALATION	1.11E-08
AIR IMMERSION	2.57E-16
GROUND SURFACE	1.03E-11
INTERNAL	1.13E-08
EXTERNAL	1.03E-11
TOTAL	1.14E-08

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SUMMARY  
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NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	8.92E-09
U-235	1.97E-10
U-238	2.24E-09
TOTAL	1.14E-08

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SUMMARY  
Page 5INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)  
(All Radionuclides and Pathways)

Direction	Distance (m)						
	1215	1694	2479	1410	2112	2757	1956
N	3.9E-04	2.3E-04	1.2E-04	3.1E-04	1.6E-04	1.0E-04	1.8E-04
NNW	1.6E-04	9.7E-05	5.4E-05	1.3E-04	6.8E-05	4.6E-05	7.7E-05
NW	1.4E-04	8.5E-05	4.8E-05	1.1E-04	6.1E-05	4.1E-05	6.8E-05
WNW	1.2E-04	7.3E-05	4.1E-05	9.7E-05	5.2E-05	3.5E-05	5.8E-05
W	1.9E-04	1.1E-04	6.0E-05	1.5E-04	7.7E-05	5.1E-05	8.6E-05
WSW	4.8E-04	2.8E-04	1.5E-04	3.8E-04	1.9E-04	1.3E-04	2.2E-04
SW	3.2E-04	1.9E-04	1.0E-04	2.5E-04	1.3E-04	8.5E-05	1.5E-04
SSW	4.1E-04	2.4E-04	1.3E-04	3.2E-04	1.7E-04	1.1E-04	1.9E-04
S	4.0E-04	2.3E-04	1.2E-04	3.1E-04	1.6E-04	1.0E-04	1.8E-04
SSE	3.8E-04	2.2E-04	1.2E-04	2.9E-04	1.5E-04	9.7E-05	1.7E-04
SE	3.7E-04	2.1E-04	1.1E-04	2.9E-04	1.5E-04	9.6E-05	1.7E-04
ESE	5.0E-04	2.9E-04	1.5E-04	3.9E-04	2.0E-04	1.3E-04	2.3E-04
E	3.5E-04	2.0E-04	1.1E-04	2.8E-04	1.4E-04	9.2E-05	1.6E-04
ENE	3.8E-04	2.2E-04	1.2E-04	3.0E-04	1.5E-04	9.9E-05	1.7E-04
NE	4.2E-04	2.4E-04	1.3E-04	3.3E-04	1.7E-04	1.1E-04	1.9E-04
NNE	8.0E-04	4.6E-04	2.5E-04	6.2E-04	3.2E-04	2.1E-04	3.6E-04

Direction	Distance (m)						
	1810	1142	1833	1902	1885	2817	2003
N	2.0E-04	4.3E-04	2.0E-04	1.9E-04	1.9E-04	9.9E-05	1.7E-04
NNW	8.7E-05	1.8E-04	8.5E-05	8.0E-05	8.2E-05	4.4E-05	7.4E-05
NW	7.7E-05	1.6E-04	7.5E-05	7.1E-05	7.2E-05	3.9E-05	6.6E-05
WNW	6.6E-05	1.4E-04	6.4E-05	6.1E-05	6.2E-05	3.4E-05	5.6E-05
W	9.8E-05	2.1E-04	9.6E-05	9.0E-05	9.2E-05	4.9E-05	8.3E-05
WSW	2.5E-04	5.4E-04	2.4E-04	2.3E-04	2.3E-04	1.2E-04	2.1E-04
SW	1.7E-04	3.6E-04	1.6E-04	1.5E-04	1.6E-04	8.2E-05	1.4E-04
SSW	2.1E-04	4.6E-04	2.1E-04	2.0E-04	2.0E-04	1.0E-04	1.8E-04
S	2.1E-04	4.4E-04	2.0E-04	1.9E-04	1.9E-04	1.0E-04	1.7E-04
SSE	1.9E-04	4.2E-04	1.9E-04	1.8E-04	1.8E-04	9.4E-05	1.6E-04
SE	1.9E-04	4.0E-04	1.9E-04	1.8E-04	1.8E-04	9.3E-05	1.6E-04
ESE	2.6E-04	5.6E-04	2.5E-04	2.4E-04	2.4E-04	1.3E-04	2.2E-04
E	1.8E-04	3.9E-04	1.8E-04	1.7E-04	1.7E-04	8.9E-05	1.5E-04

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ENE	2.0E-04	4.2E-04	1.9E-04	1.8E-04	1.8E-04	9.6E-05	1.7E-04
NE	2.2E-04	4.6E-04	2.1E-04	2.0E-04	2.0E-04	1.1E-04	1.8E-04
NNE	4.1E-04	8.8E-04	4.0E-04	3.8E-04	3.9E-04	2.0E-04	3.5E-04

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SUMMARY  
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INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)  
(All Radionuclides and Pathways)

Direction	Distance (m)					
	2244	2339	2299	2258	2291	1621
N	1.4E-04	1.3E-04	1.4E-04	1.4E-04	1.4E-04	2.4E-04
NNW	6.2E-05	5.8E-05	6.0E-05	6.2E-05	6.0E-05	1.0E-04
NW	5.5E-05	5.2E-05	5.3E-05	5.5E-05	5.4E-05	9.1E-05
WNW	4.7E-05	4.4E-05	4.6E-05	4.7E-05	4.6E-05	7.8E-05
W	7.0E-05	6.5E-05	6.7E-05	6.9E-05	6.7E-05	1.2E-04
WSW	1.8E-04	1.6E-04	1.7E-04	1.7E-04	1.7E-04	3.0E-04
SW	1.2E-04	1.1E-04	1.1E-04	1.2E-04	1.1E-04	2.0E-04
SSW	1.5E-04	1.4E-04	1.4E-04	1.5E-04	1.5E-04	2.6E-04
S	1.4E-04	1.4E-04	1.4E-04	1.4E-04	1.4E-04	2.5E-04
SSE	1.4E-04	1.3E-04	1.3E-04	1.3E-04	1.3E-04	2.3E-04
SE	1.3E-04	1.3E-04	1.3E-04	1.3E-04	1.3E-04	2.3E-04
ESE	1.8E-04	1.7E-04	1.7E-04	1.8E-04	1.8E-04	3.1E-04
E	1.3E-04	1.2E-04	1.2E-04	1.3E-04	1.2E-04	2.2E-04
ENE	1.4E-04	1.3E-04	1.3E-04	1.4E-04	1.3E-04	2.4E-04
NE	1.5E-04	1.4E-04	1.5E-04	1.5E-04	1.5E-04	2.6E-04
NNE	2.9E-04	2.7E-04	2.8E-04	2.9E-04	2.8E-04	4.9E-04

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SUMMARY  
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INDIVIDUAL LIFETIME RISK (deaths)  
(All Radionuclides and Pathways)

Direction	Distance (m)						
	1215	1694	2479	1410	2112	2757	1956
N	5.0E-09	2.9E-09	1.5E-09	3.9E-09	2.0E-09	1.3E-09	2.3E-09
NNW	2.1E-09	1.2E-09	6.5E-10	1.6E-09	8.4E-10	5.5E-10	9.5E-10
NW	1.8E-09	1.1E-09	5.7E-10	1.4E-09	7.4E-10	4.8E-10	8.4E-10
WNW	1.5E-09	9.0E-10	4.9E-10	1.2E-09	6.3E-10	4.1E-10	7.1E-10
W	2.4E-09	1.4E-09	7.3E-10	1.9E-09	9.4E-10	6.1E-10	1.1E-09
WSW	6.2E-09	3.5E-09	1.9E-09	4.8E-09	2.5E-09	1.6E-09	2.8E-09
SW	4.1E-09	2.4E-09	1.3E-09	3.2E-09	1.6E-09	1.0E-09	1.9E-09
SSW	5.3E-09	3.0E-09	1.6E-09	4.1E-09	2.1E-09	1.3E-09	2.4E-09
S	5.1E-09	2.9E-09	1.5E-09	4.0E-09	2.0E-09	1.3E-09	2.3E-09
SSE	4.8E-09	2.7E-09	1.4E-09	3.7E-09	1.9E-09	1.2E-09	2.1E-09
SE	4.7E-09	2.7E-09	1.4E-09	3.7E-09	1.9E-09	1.2E-09	2.1E-09
ESE	6.5E-09	3.7E-09	1.9E-09	5.0E-09	2.5E-09	1.6E-09	2.9E-09
E	4.5E-09	2.6E-09	1.4E-09	3.5E-09	1.8E-09	1.1E-09	2.0E-09
ENE	4.8E-09	2.8E-09	1.5E-09	3.8E-09	1.9E-09	1.2E-09	2.2E-09
NE	5.3E-09	3.1E-09	1.6E-09	4.2E-09	2.1E-09	1.4E-09	2.4E-09
NNE	1.0E-08	5.9E-09	3.1E-09	8.0E-09	4.1E-09	2.6E-09	4.6E-09

Direction	Distance (m)						
	1810	1142	1833	1902	1885	2817	2003
N	2.6E-09	5.6E-09	2.5E-09	2.4E-09	2.4E-09	1.2E-09	2.2E-09
NNW	1.1E-09	2.3E-09	1.1E-09	1.0E-09	1.0E-09	5.3E-10	9.1E-10
NW	9.5E-10	2.0E-09	9.3E-10	8.8E-10	8.9E-10	4.7E-10	8.1E-10
WNW	8.1E-10	1.7E-09	7.9E-10	7.4E-10	7.5E-10	4.0E-10	6.8E-10
W	1.2E-09	2.6E-09	1.2E-09	1.1E-09	1.1E-09	5.9E-10	1.0E-09
WSW	3.2E-09	6.9E-09	3.1E-09	2.9E-09	3.0E-09	1.5E-09	2.7E-09
SW	2.1E-09	4.6E-09	2.1E-09	1.9E-09	2.0E-09	1.0E-09	1.8E-09
SSW	2.7E-09	5.9E-09	2.6E-09	2.5E-09	2.5E-09	1.3E-09	2.3E-09
S	2.6E-09	5.6E-09	2.5E-09	2.4E-09	2.4E-09	1.2E-09	2.2E-09
SSE	2.4E-09	5.4E-09	2.4E-09	2.2E-09	2.3E-09	1.2E-09	2.1E-09
SE	2.4E-09	5.2E-09	2.4E-09	2.2E-09	2.2E-09	1.2E-09	2.0E-09
ESE	3.3E-09	7.2E-09	3.2E-09	3.0E-09	3.1E-09	1.6E-09	2.8E-09
E	2.3E-09	5.0E-09	2.3E-09	2.1E-09	2.2E-09	1.1E-09	1.9E-09

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ENE	2.5E-09	5.4E-09	2.4E-09	2.3E-09	2.3E-09	1.2E-09	2.1E-09
NE	2.7E-09	5.9E-09	2.7E-09	2.5E-09	2.6E-09	1.3E-09	2.3E-09
NNE	5.3E-09	1.1E-08	5.2E-09	4.9E-09	4.9E-09	2.5E-09	4.5E-09

Feb 18, 1998 12:59 am

SUMMARY  
Page 8

INDIVIDUAL LIFETIME RISK (deaths)  
(All Radionuclides and Pathways)

Distance (m)

Direction	2244	2339	2299	2258	2291	1621
N	1.8E-09	1.7E-09	1.7E-09	1.8E-09	1.7E-09	3.1E-09
NNW	7.6E-10	7.1E-10	7.3E-10	7.5E-10	7.4E-10	1.3E-09
NW	6.7E-10	6.3E-10	6.5E-10	6.7E-10	6.5E-10	1.1E-09
WNW	5.7E-10	5.3E-10	5.5E-10	5.6E-10	5.5E-10	9.6E-10
W	8.6E-10	8.0E-10	8.2E-10	8.5E-10	8.3E-10	1.5E-09
WSW	2.2E-09	2.1E-09	2.1E-09	2.2E-09	2.1E-09	3.8E-09
SW	1.5E-09	1.4E-09	1.4E-09	1.5E-09	1.4E-09	2.5E-09
SSW	1.9E-09	1.8E-09	1.8E-09	1.9E-09	1.8E-09	3.3E-09
S	1.8E-09	1.7E-09	1.7E-09	1.8E-09	1.8E-09	3.1E-09
SSE	1.7E-09	1.6E-09	1.6E-09	1.7E-09	1.6E-09	2.9E-09
SE	1.7E-09	1.6E-09	1.6E-09	1.7E-09	1.6E-09	2.9E-09
ESE	2.3E-09	2.1E-09	2.2E-09	2.3E-09	2.2E-09	4.0E-09
E	1.6E-09	1.5E-09	1.5E-09	1.6E-09	1.6E-09	2.8E-09
ENE	1.7E-09	1.6E-09	1.7E-09	1.7E-09	1.7E-09	3.0E-09
NE	1.9E-09	1.8E-09	1.8E-09	1.9E-09	1.8E-09	3.3E-09
NNE	3.7E-09	3.4E-09	3.5E-09	3.7E-09	3.6E-09	6.3E-09

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**DECONTAMINATION OF STRUCTURAL STEEL**

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**ATTACHMENT 1 - EMISSION INFORMATION  
DECONTAMINATION OF STRUCTURAL STEEL**

Page 1 of 2

Radionuclide Emissions:

If steel from the Plant 1 Ore Silo Project is decontaminated then the calculations and modeling performed in the 1995 Permit Information Summary (Attachment 2) is sufficient to show continuous sampling is not required. This document will not duplicate those calculations in this document.

This document evaluates steel contaminated with uranium and not thorium. The average removable contamination levels on the steel beams will be less than 10,000/100 cm<sup>2</sup>, and the average fixed levels will be less than 100,000/100 cm<sup>2</sup>. 50 tons of steel will be decontaminated in FY-1997. The fixed contamination is considered removable for purposes of calculating the emissions from the uranium contaminated steel. In the 1995 PIS, it was determined 75 tons of steel has a total surface area of 15,000 ft<sup>2</sup>. The calculated total activity on 50 tons of uranium contaminated steel is:

$$\begin{array}{c}
 \frac{110,000 \text{ dpm}}{100 \text{ cm}^2} \quad \left| \frac{6.45 \text{ cm}^2}{\text{in}^2} \right. \quad \left| \frac{144 \text{ in}^2}{\text{ft}^2} \right. \quad \left| \frac{50 \text{ t}}{\text{yr}} \right. \quad \left| \frac{4.5E-07 \mu\text{Ci}}{\text{dpm}} \right. \quad \left| \frac{15,000 \text{ ft}^2}{75 \text{ t}} \right. \\
 \\ = 4597 \mu\text{Ci} \\
 \text{yr}
 \end{array}$$

Under 40 CFR Part 61, Section 61.93, the release rate for each point source (stack or vent) shall be determined. There are two emission points for the grit blasting operation: the grit blaster, and the ventilation booth. 40 CFR Part 61 Appendix D protocols were used to estimate the potential (uncontrolled) emissions from the ventilation booth.

Potential emissions from the ventilation booth are:

$$4597 \mu\text{Ci} / \text{yr} \times 0.001 \text{ (Appendix D emission factor for particulate solids)} = 4.6 \mu\text{Ci} / \text{yr}$$

Potential emissions from the grit blaster were determined by assuming total emissions were controlled by 99%. The control being applied in this instance is the vacuum nature of the blaster which is inherent to the (normal) operation of the machine. The efficiency of the machines HEPA filter (99.97%) was not used.

$$4597 \mu\text{Ci} / \text{yr} \times (1 - .99) = 45.97 \mu\text{Ci} / \text{yr}$$

Attachments 3 & 4 are the CAP88-PC model runs for the project point sources. The model indicates no continuous sampling is required for the grit blasting of 50 tons of uranium contaminated steel for either point source. If the project decides to continue this decontamination method past FY-1997, it could decontaminate 20 times (300,000 ft<sup>2</sup>) this amount of uranium contaminated steel per calendar year and still not require continuous monitoring for either point source.

Lead Emissions:

For this project, it is assumed there is 25 grams of paint per ft<sup>2</sup> of steel and 10% of the paint by weight is lead. The grit blaster and the ventilation booth are equipped with HEPA filters.

$$\begin{array}{c|c|c|c|c|c}
 \frac{10,000 \text{ ft}^2}{\text{yr}} & \frac{25 \text{ g}}{\text{ft}^2} & \frac{1 \text{ lb pb}}{10 \text{ lb paint}} & \frac{\text{kg}}{1000 \text{ g}} & \frac{2.205 \text{ lb}}{\text{kg}} & \frac{0.0003}{\text{lb}}
 \\ 
 \hline
 & & & & & \\
 & & & & & \\
 & & = 0.0165 \text{ lb/year} & & & 
 \end{array}$$

The lead in structural paint at the FEMP is typically lead oxide but in some instances it is lead chromate. From the ACGIH Handbook for Threshold Limit Values, 1993-1994, Table of Adopted Values, the TLV for lead chromate is 0.012 mg/m<sup>3</sup> and the TLV for inorganic lead compounds, from the Table of Intended Changes, is 0.05 mg/m<sup>3</sup>.

The lead chromate would have the more conservative MAGLC.

$$(0.012 \text{ mg/m}^3)/100 = 0.00012 \text{ mg/m}^3 = 0.12 \mu\text{g/m}^3$$

Maximum 1 hour emission rate of the lead paint from the activity is:

$$\begin{array}{c|c|c|c|c|c|c|c}
 \frac{.0165 \text{ lb}}{\text{yr}} & \frac{1000 \text{ g}}{2.205 \text{ lb}} & \frac{\text{yr}}{52 \text{ wk}} & \frac{\text{wk}}{5 \text{ day}} & \frac{\text{day}}{24 \text{ hr}} & \frac{\text{hr}}{60 \text{ min}} & \frac{\text{min}}{60 \text{ sec}} & 
 \\ 
 \hline
 & & & & & & & \\
 & & & & & & & \\
 & = 3.3 \text{ E-07 g/s} & & & & & & 
 \end{array}$$

Other process inputs:

Flow rate of air filtration devices: 1000 cfm  
 Stack height: 2 m  
 Stack diameter: 0.4 m  
 Distance to fenceline: 423 m

The BEE-Line Screen3 model result is attached (Attachment 5). The model results show this activity as planned is under the MAGLC value (by approximately 180x). Therefore, no additional controls for Lead-emissions are necessary even if 300,000 ft<sup>2</sup> of steel is to be decontaminated.

Particulate Emissions:

Particulate emission estimates should be two-thirds those estimated in the 1995 PIS for the decontamination of Plant 1 Ore Silo steel (letter to Jack Craig from Terence Hagen dated June 30, 1995). These calculations will not be duplicated in this document.

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**C A P 8 8 - P C**

**Version 1.00**

**Clean Air Act Assessment Package - 1988**

**S Y N O P S I S   R E P O R T**

**Non-Radon Individual Assessment**

**June 19, 1997 10:30 am**

Facility: Fernald Environmental Management Project  
Address: P.O. Box 538704  
7400 Willey Road  
City: Cincinnati  
State: OH Zip: 45253-8704

**Effective Dose Equivalent**  
(mrem/year)

---

**3.26E-03**

---

**At This Location: 815 Meters North Northeast**

**Source Category:**

Source Type: Stack  
Emission Year: 96

**Comments: Grit blasting of contaminated steel for recycling/  
reuse.**

Dataset Name: 78-GBP  
Dataset Date: June 19, 1997 10:27 am  
Wind File: WNDFILES\FEMPSTD.WND

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Jun 19, 1997 10:30 am

SYNOPSIS  
Page 1

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 815 Meters North Northeast  
Lifetime Fatal Cancer Risk: 4.28E-08

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	4.85E-06
BREAST	5.63E-06
R MAR	1.47E-04
LUNGS	2.61E-02
THYROID	4.75E-06
ENDOST	1.89E-03
RMNDR	1.70E-04
EFFEC	3.26E-03

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Jun 19, 1997 10:30 am

SYNOPSIS  
Page 2

RADIONUCLIDE EMISSIONS DURING THE YEAR 96

uclide	Class	Size	Source	TOTAL Ci/Y
			#1 Ci/Y	
-238	Y	0.30	4.6E-05	4.6E-05

SITE INFORMATION

Temperature: 20 degrees C  
Precipitation: 146 cm/y  
Mixing Height: 965 m

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Jun 19, 1997 10:30 am

SYNOPSIS  
Page 3

SOURCE INFORMATION

Source Number: 1

Stack Height (m): 2.00  
Diameter (m): 0.47

Plume Rise  
Momentum (m/s): 2.56E+01  
(Exit Velocity)

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.  
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

815	918	1951	1779	1582	1538	1662	1793	1594	1482
951	1505	1812	1142	1129					

**2264**

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E   A N D   R I S K   E Q U I V A L E N T   S U M M A R I E S

Non-Radon Individual Assessment  
Jun 19, 1997 10:30 am

Facility: Fernald Environmental Management Project  
Address: P.O. Box 538704  
          7400 Willey Road  
City: Cincinnati  
State: OH               Zip: 45253-8704

Source Category:

Source Type: Stack  
Emission Year: 96

Comments: Grit blasting of contaminated steel for recycling/  
reuse.

Dataset Name: 78-GBP  
Dataset Date: Jun 19, 1997 10:27 am  
Wind File: WNDFILES\FEMPSTD.WND

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Jun 19, 1997 10:30 am

SUMMARY  
Page 1

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	4.85E-06
BREAST	5.63E-06
R MAR	1.47E-04
LUNGS	2.61E-02
THYROID	4.75E-06
ENDOST	1.89E-03
RMNDR	1.70E-04
EFFEC	3.26E-03

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.21E-04
INHALATION	3.14E-03
AIR IMMERSION	9.70E-13
GROUND SURFACE	1.95E-07
INTERNAL	3.26E-03
EXTERNAL	1.95E-07
TOTAL	3.26E-03

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SUMMARY  
Page 2

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-238	3.26E-03
TOTAL	3.26E-03

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SUMMARY  
Page 3

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	1.84E-10
BONE	1.02E-10
THYROID	8.49E-13
BREAST	1.05E-11
LUNG	4.21E-08
STOMACH	6.81E-12
BOWEL	1.42E-11
LIVER	5.50E-12
PANCREAS	4.45E-12
URINARY	3.69E-10
OTHER	5.44E-12
TOTAL	4.28E-08

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	6.72E-10
INHALATION	4.22E-08
AIR IMMERSION	2.06E-17
GROUND SURFACE	4.11E-12
INTERNAL	4.28E-08
EXTERNAL	4.11E-12
TOTAL	4.28E-08

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SUMMARY  
Page 4

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-238	4.28E-08
TOTAL	4.28E-08

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SUMMARY  
Page 5INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)  
(All Radionuclides and Pathways)

Direction	Distance (m)						
	815	918	1951	1779	1582	1538	1662
N	1.6E-03	1.3E-03	3.9E-04	4.5E-04	5.5E-04	5.7E-04	5.0E-04
NNW	6.9E-04	5.6E-04	1.7E-04	2.0E-04	2.4E-04	2.5E-04	2.2E-04
NW	5.6E-04	4.6E-04	1.5E-04	1.7E-04	2.0E-04	2.1E-04	1.9E-04
WNW	4.8E-04	4.0E-04	1.3E-04	1.4E-04	1.7E-04	1.8E-04	1.6E-04
W	7.0E-04	5.8E-04	1.8E-04	2.1E-04	2.5E-04	2.6E-04	2.3E-04
WSW	2.0E-03	1.6E-03	4.8E-04	5.6E-04	6.7E-04	7.0E-04	6.2E-04
SW	1.3E-03	1.0E-03	3.2E-04	3.6E-04	4.4E-04	4.6E-04	4.1E-04
SSW	1.8E-03	1.5E-03	4.2E-04	4.8E-04	5.9E-04	6.1E-04	5.4E-04
S	1.6E-03	1.3E-03	3.9E-04	4.6E-04	5.5E-04	5.8E-04	5.1E-04
SSE	1.6E-03	1.3E-03	3.7E-04	4.3E-04	5.2E-04	5.5E-04	4.8E-04
SE	1.3E-03	1.1E-03	3.5E-04	4.0E-04	4.8E-04	5.1E-04	4.5E-04
ESE	2.0E-03	1.6E-03	4.9E-04	5.7E-04	6.9E-04	7.2E-04	6.3E-04
E	1.4E-03	1.1E-03	3.4E-04	4.0E-04	4.8E-04	5.0E-04	4.4E-04
ENE	1.6E-03	1.3E-03	3.8E-04	4.4E-04	5.3E-04	5.5E-04	4.9E-04
NE	1.8E-03	1.4E-03	4.1E-04	4.8E-04	5.8E-04	6.1E-04	5.4E-04
NNE	3.3E-03	2.7E-03	7.9E-04	9.2E-04	1.1E-03	1.2E-03	1.0E-03

Direction	Distance (m)						
	1793	1594	1482	951	1505	1812	1142
N	4.5E-04	5.4E-04	6.1E-04	1.2E-03	5.9E-04	4.4E-04	9.2E-04
NNW	1.9E-04	2.3E-04	2.6E-04	5.3E-04	2.5E-04	1.9E-04	3.9E-04
NW	1.7E-04	2.0E-04	2.2E-04	4.3E-04	2.2E-04	1.6E-04	3.3E-04
WNW	1.4E-04	1.7E-04	1.9E-04	3.7E-04	1.8E-04	1.4E-04	2.8E-04
W	2.1E-04	2.5E-04	2.8E-04	5.5E-04	2.7E-04	2.1E-04	4.1E-04
WSW	5.5E-04	6.6E-04	7.5E-04	1.5E-03	7.3E-04	5.4E-04	1.1E-03
SW	3.6E-04	4.3E-04	4.9E-04	9.8E-04	4.7E-04	3.5E-04	7.3E-04
SSW	4.8E-04	5.8E-04	6.5E-04	1.4E-03	6.4E-04	4.7E-04	1.0E-03
S	4.5E-04	5.4E-04	6.1E-04	1.3E-03	6.0E-04	4.4E-04	9.3E-04
SSE	4.3E-04	5.2E-04	5.8E-04	1.2E-03	5.7E-04	4.2E-04	8.9E-04
SE	4.0E-04	4.8E-04	5.3E-04	1.0E-03	5.2E-04	3.9E-04	7.9E-04
ESE	5.6E-04	6.8E-04	7.6E-04	1.6E-03	7.4E-04	5.5E-04	1.2E-03
E	3.9E-04	4.7E-04	5.3E-04	1.1E-03	5.2E-04	3.9E-04	8.0E-04
ENE	4.3E-04	5.2E-04	5.9E-04	1.2E-03	5.7E-04	4.2E-04	8.9E-04
NE	4.7E-04	5.7E-04	6.5E-04	1.3E-03	6.3E-04	4.7E-04	9.8E-04
NNE	9.0E-04	1.1E-03	1.2E-03	2.5E-03	1.2E-03	8.9E-04	1.9E-03

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SUMMARY  
Page 6

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)  
(All Radionuclides and Pathways)

Distance (m)

Direction 1129

N	9.4E-04
NNW	4.0E-04
NW	3.3E-04
WNW	2.8E-04
W	4.2E-04
WSW	1.2E-03
SW	7.4E-04
SSW	1.0E-03
S	9.5E-04
SSE	9.1E-04
SE	8.0E-04
ESE	1.2E-03
E	8.2E-04
ENE	9.1E-04
NE	1.0E-03
NNE	1.9E-03

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Jun 19, 1997 10:30 am

SUMMARY  
Page 7INDIVIDUAL LIFETIME RISK (deaths)  
(All Radionuclides and Pathways)

## Distance (m)

Direction	815	918	1951	1779	1582	1538	1662
N	2.1E-08	1.7E-08	5.0E-09	5.8E-09	7.1E-09	7.4E-09	6.5E-09
NNW	9.1E-09	7.3E-09	2.1E-09	2.5E-09	3.0E-09	3.1E-09	2.8E-09
NW	7.2E-09	5.9E-09	1.8E-09	2.1E-09	2.5E-09	2.7E-09	2.4E-09
WNW	6.3E-09	5.1E-09	1.6E-09	1.8E-09	2.2E-09	2.2E-09	2.0E-09
W	9.1E-09	7.5E-09	2.3E-09	2.7E-09	3.2E-09	3.4E-09	3.0E-09
WSW	2.6E-08	2.1E-08	6.2E-09	7.2E-09	8.7E-09	9.1E-09	8.1E-09
SW	1.7E-08	1.4E-08	4.0E-09	4.7E-09	5.7E-09	5.9E-09	5.2E-09
SSW	2.4E-08	1.9E-08	5.4E-09	6.2E-09	7.6E-09	8.0E-09	7.0E-09
S	2.1E-08	1.7E-08	5.1E-09	5.9E-09	7.1E-09	7.5E-09	6.6E-09
SSE	2.1E-08	1.7E-08	4.8E-09	5.6E-09	6.8E-09	7.1E-09	6.2E-09
SE	1.7E-08	1.4E-08	4.5E-09	5.2E-09	6.3E-09	6.5E-09	5.8E-09
ESE	2.6E-08	2.2E-08	6.3E-09	7.4E-09	8.9E-09	9.3E-09	8.2E-09
E	1.8E-08	1.5E-08	4.4E-09	5.1E-09	6.2E-09	6.5E-09	5.7E-09
ENE	2.1E-08	1.7E-08	4.8E-09	5.6E-09	6.8E-09	7.1E-09	6.3E-09
NE	2.3E-08	1.9E-08	5.3E-09	6.2E-09	7.5E-09	7.9E-09	6.9E-09
NNE	4.3E-08	3.5E-08	1.0E-08	1.2E-08	1.4E-08	1.5E-08	1.3E-08

## Distance (m)

Direction	1793	1594	1482	951	1505	1812	1142
N	5.8E-09	7.0E-09	7.9E-09	1.6E-08	7.7E-09	5.7E-09	1.2E-08
NNW	2.4E-09	3.0E-09	3.3E-09	6.9E-09	3.2E-09	2.4E-09	5.1E-09
NW	2.1E-09	2.5E-09	2.8E-09	5.6E-09	2.7E-09	2.1E-09	4.2E-09
WNW	1.8E-09	2.1E-09	2.4E-09	4.8E-09	2.3E-09	1.7E-09	3.6E-09
W	2.6E-09	3.2E-09	3.6E-09	7.1E-09	3.5E-09	2.6E-09	5.3E-09
WSW	7.1E-09	8.6E-09	9.7E-09	2.0E-08	9.5E-09	7.0E-09	1.5E-08
SW	4.6E-09	5.6E-09	6.3E-09	1.3E-08	6.1E-09	4.6E-09	9.5E-09
SSW	6.2E-09	7.5E-09	8.5E-09	1.8E-08	8.3E-09	6.1E-09	1.3E-08
S	5.8E-09	7.0E-09	7.9E-09	1.6E-08	7.7E-09	5.7E-09	1.2E-08
SSE	5.5E-09	6.7E-09	7.5E-09	1.6E-08	7.3E-09	5.4E-09	1.2E-08
SE	5.2E-09	6.2E-09	6.9E-09	1.4E-08	6.8E-09	5.1E-09	1.0E-08
ESE	7.3E-09	8.8E-09	9.9E-09	2.0E-08	9.6E-09	7.1E-09	1.5E-08
E	5.1E-09	6.1E-09	6.9E-09	1.4E-08	6.7E-09	5.0E-09	1.0E-08
ENE	5.6E-09	6.7E-09	7.6E-09	1.6E-08	7.4E-09	5.5E-09	1.2E-08
NE	6.1E-09	7.4E-09	8.4E-09	1.7E-08	8.2E-09	6.0E-09	1.3E-08
NNE	1.2E-08	1.4E-08	1.6E-08	3.3E-08	1.6E-08	1.2E-08	2.4E-08

INDIVIDUAL LIFETIME RISK (deaths)  
(All Radionuclides and Pathways)

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Distance (m)Direction 1129

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N	1.2E-08
NNW	5.2E-09
NW	4.3E-09
WNW	3.6E-09
W	5.4E-09
WSW	1.5E-08
SW	9.7E-09
SSW	1.3E-08
S	1.2E-08
SSE	1.2E-08
SE	1.0E-08
ESE	1.5E-08
E	1.1E-08
ENE	1.2E-08
NE	1.3E-08
NNE	2.5E-08

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**C A P 8 8 - P C**

Version 1.00

**Clean Air Act Assessment Package - 1988**

**S Y N O P S I S   R E P O R T**

Non-Radon Individual Assessment  
June 19, 1997 10:30 am

Facility: Fernald Environmental Management Project  
Address: P.O. Box 538704  
7400 Willey Road  
City: Cincinnati  
State: OH Zip: 45253-8704

**Effective Dose Equivalent  
(mrem/year)**

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3.26E-04

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At This Location: 815 Meters North Northeast

Source Category:  
Source Type: Stack  
Emission Year: 96

Comments: Grit blasting of contaminated steel for recycling/  
reuse.

Dataset Name: 78-GBFVB  
Dataset Date: June 19, 1997 10:27 am  
Wind File: WNDFILES\FEMPSTD.WND

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on 19, 1997 10:30 am

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SYNOPSIS  
Page 1

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 815 Meters North Northeast  
Lifetime Fatal Cancer Risk: 4.28E-09

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	4.85E-07
BREAST	5.63E-07
R MAR	1.47E-05
LUNGS	2.61E-03
THYROID	4.75E-07
ENDOST	1.89E-04
RMNDR	1.70E-05
EFFEC	3.26E-04

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SYNOPSIS  
Page 2

RADIOMUCLIDE EMISSIONS DURING THE YEAR 96.

Nuclide	Class	Size	Source	TOTAL
			#1 Ci/Y	
U-238	Y	0.30	4.6E-06	4.6E-06

SITE INFORMATION

Temperature: 20 degrees C  
Precipitation: 146 cm/Y  
Mixing Height: 965 m

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Jun 19, 1997 10:30 am

SYNOPSIS  
Page 3

SOURCE INFORMATION

Source Number: 1

Stack Height (m): 2.00  
Diameter (m): 0.47

Plume Rise  
Momentum (m/s): 2.56E+01  
(Exit Velocity)

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.  
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

815	918	1951	1779	1582	1538	1662	1793	1594	1482
951	1505	1812	1142	1129					

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C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E   A N D   R I S K   E Q U I V A L E N T   S U M M A R I E S

Non-Radon Individual Assessment

Jun 19, 1997 10:30 am

Facility: Fernald Environmental Management Project  
Address: P.O. Box 538704  
          7400 Willey Road  
City: Cincinnati  
State: OH              Zip: 45253-8704

Source Category:

Source Type: Stack  
Emission Year: 96

Comments: Grit blasting of contaminated steel for recycling/  
reuse.

Dataset Name: 78-GBFVB  
Dataset Date: Jun 19, 1997 10:29 am  
Wind File: WNDFILES\FEMPSTD.WND

un 19, 1997 10:30 am

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SUMMARY  
Page 1

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	4.85E-07
BREAST	5.63E-07
R MAR	1.47E-05
LUNGS	2.61E-03
THYROID	4.75E-07
ENDOST	1.89E-04
RMNDR	1.70E-05
EFFEC	3.26E-04

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.21E-05
INHALATION	3.14E-04
AIR IMMERSION	9.70E-14
GROUND SURFACE	1.95E-08
INTERNAL	3.26E-04
EXTERNAL	1.95E-08
TOTAL	3.26E-04

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SUMMARY  
Page 2

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-238	3.26E-04
TOTAL	3.26E-04

**2264**

Jun 19, 1997 10:30 am

SUMMARY  
Page 3

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	1.84E-11
BONE	1.02E-11
THYROID	8.49E-14
BREAST	1.05E-12
LUNG	4.21E-09
STOMACH	6.81E-13
BOWEL	1.42E-12
LIVER	5.50E-13
PANCREAS	4.45E-13
URINARY	3.69E-11
OTHER	5.44E-13
TOTAL	4.28E-09

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	6.72E-11
INHALATION	4.22E-09
AIR IMMERSION	2.06E-18
GROUND SURFACE	4.11E-13
INTERNAL	4.28E-09
EXTERNAL	4.11E-13
TOTAL	4.28E-09

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SUMMARY  
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NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-238	4.28E-09
TOTAL	4.28E-09

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SUMMARY  
Page 5INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)  
(All Radionuclides and Pathways)

Direction	Distance (m)						
	815	918	1951	1779	1582	1538	1662
N	1.6E-04	1.3E-04	3.9E-05	4.5E-05	5.5E-05	5.7E-05	5.0E-05
NNW	6.9E-05	5.6E-05	1.7E-05	2.0E-05	2.4E-05	2.5E-05	2.2E-05
NW	5.6E-05	4.6E-05	1.5E-05	1.7E-05	2.0E-05	2.1E-05	1.9E-05
WNW	4.8E-05	4.0E-05	1.3E-05	1.4E-05	1.7E-05	1.8E-05	1.6E-05
W	7.0E-05	5.8E-05	1.8E-05	2.1E-05	2.5E-05	2.6E-05	2.3E-05
WSW	2.0E-04	1.6E-04	4.8E-05	5.6E-05	6.7E-05	7.0E-05	6.2E-05
SW	1.3E-04	1.0E-04	3.2E-05	3.6E-05	4.4E-05	4.6E-05	4.1E-05
SSW	1.8E-04	1.5E-04	4.2E-05	4.8E-05	5.9E-05	6.1E-05	5.4E-05
S	1.6E-04	1.3E-04	3.9E-05	4.6E-05	5.5E-05	5.8E-05	5.1E-05
SSE	1.6E-04	1.3E-04	3.7E-05	4.3E-05	5.2E-05	5.5E-05	4.8E-05
SE	1.3E-04	1.1E-04	3.5E-05	4.0E-05	4.8E-05	5.1E-05	4.5E-05
ESE	2.0E-04	1.6E-04	4.9E-05	5.7E-05	6.9E-05	7.2E-05	6.3E-05
E	1.4E-04	1.1E-04	3.4E-05	4.0E-05	4.8E-05	5.0E-05	4.4E-05
ENE	1.6E-04	1.3E-04	3.8E-05	4.4E-05	5.3E-05	5.5E-05	4.9E-05
NE	1.8E-04	1.4E-04	4.1E-05	4.8E-05	5.8E-05	6.1E-05	5.4E-05
NNE	3.3E-04	2.7E-04	7.9E-05	9.2E-05	1.1E-04	1.2E-04	1.0E-04

Direction	Distance (m)						
	1793	1594	1482	951	1505	1812	1142
N	4.5E-05	5.4E-05	6.1E-05	1.2E-04	5.9E-05	4.4E-05	9.2E-05
NNW	1.9E-05	2.3E-05	2.6E-05	5.3E-05	2.5E-05	1.9E-05	3.9E-05
NW	1.7E-05	2.0E-05	2.2E-05	4.3E-05	2.2E-05	1.6E-05	3.3E-05
WNW	1.4E-05	1.7E-05	1.9E-05	3.7E-05	1.8E-05	1.4E-05	2.8E-05
W	2.1E-05	2.5E-05	2.8E-05	5.5E-05	2.7E-05	2.1E-05	4.1E-05
WSW	5.5E-05	6.6E-05	7.5E-05	1.5E-04	7.3E-05	5.4E-05	1.1E-04
SW	3.6E-05	4.3E-05	4.9E-05	9.8E-05	4.7E-05	3.5E-05	7.3E-05
SSW	4.8E-05	5.8E-05	6.5E-05	1.4E-04	6.4E-05	4.7E-05	1.0E-04
S	4.5E-05	5.4E-05	6.1E-05	1.3E-04	6.0E-05	4.4E-05	9.3E-05
SSE	4.3E-05	5.2E-05	5.8E-05	1.2E-04	5.7E-05	4.2E-05	8.9E-05
SE	4.0E-05	4.8E-05	5.3E-05	1.0E-04	5.2E-05	3.9E-05	7.9E-05
ESE	5.6E-05	6.8E-05	7.6E-05	1.6E-04	7.4E-05	5.5E-05	1.2E-04
E	3.9E-05	4.7E-05	5.3E-05	1.1E-04	5.2E-05	3.9E-05	8.0E-05
ENE	4.3E-05	5.2E-05	5.9E-05	1.2E-04	5.7E-05	4.2E-05	8.9E-05
NE	4.7E-05	5.7E-05	6.5E-05	1.3E-04	6.3E-05	4.7E-05	9.8E-05
NNE	9.0E-05	1.1E-04	1.2E-04	2.5E-04	1.2E-04	8.9E-05	1.9E-04

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SUMMARY  
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INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)  
(All Radionuclides and Pathways)

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Distance (m)

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Direction 1129

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N	9.4E-05
NNW	4.0E-05
NW	3.3E-05
WNW	2.8E-05
W	4.2E-05
WSW	1.2E-04
SW	7.4E-05
SSW	1.0E-04
S	9.5E-05
SSE	9.1E-05
SE	8.0E-05
ESE	1.2E-04
E	8.2E-05
ENE	9.1E-05
NE	1.0E-04
NNE	1.9E-04

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Jun 19, 1997 10:30 am

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SUMMARY  
Page 7INDIVIDUAL LIFETIME RISK (deaths)  
(All Radionuclides and Pathways)

		Distance (m)						
Direction		815	918	1951	1779	1582	1538	1662
N	2.1E-09	1.7E-09	5.0E-10	5.8E-10	7.1E-10	7.4E-10	6.5E-10	
NNW	9.1E-10	7.3E-10	2.1E-10	2.5E-10	3.0E-10	3.1E-10	2.8E-10	
NW	7.2E-10	5.9E-10	1.8E-10	2.1E-10	2.5E-10	2.7E-10	2.4E-10	
WNW	6.3E-10	5.1E-10	1.6E-10	1.8E-10	2.2E-10	2.2E-10	2.0E-10	
W	9.1E-10	7.5E-10	2.3E-10	2.7E-10	3.2E-10	3.4E-10	3.0E-10	
WSW	2.6E-09	2.1E-09	6.2E-10	7.2E-10	8.7E-10	9.1E-10	8.1E-10	
SW	1.7E-09	1.4E-09	4.0E-10	4.7E-10	5.7E-10	5.9E-10	5.2E-10	
SSW	2.4E-09	1.9E-09	5.4E-10	6.2E-10	7.6E-10	8.0E-10	7.0E-10	
S	2.1E-09	1.7E-09	5.1E-10	5.9E-10	7.1E-10	7.5E-10	6.6E-10	
SSE	2.1E-09	1.7E-09	4.8E-10	5.6E-10	6.8E-10	7.1E-10	6.2E-10	
SE	1.7E-09	1.4E-09	4.5E-10	5.2E-10	6.3E-10	6.5E-10	5.8E-10	
ESE	2.6E-09	2.2E-09	6.3E-10	7.4E-10	8.9E-10	9.3E-10	8.2E-10	
E	1.8E-09	1.5E-09	4.4E-10	5.1E-10	6.2E-10	6.5E-10	5.7E-10	
ENE	2.1E-09	1.7E-09	4.8E-10	5.6E-10	6.8E-10	7.1E-10	6.3E-10	
NE	2.3E-09	1.9E-09	5.3E-10	6.2E-10	7.5E-10	7.9E-10	6.9E-10	
NNE	4.3E-09	3.5E-09	1.0E-09	1.2E-09	1.4E-09	1.5E-09	1.3E-09	

		Distance (m)						
Direction		1793	1594	1482	951	1505	1812	1142
N	5.8E-10	7.0E-10	7.9E-10	1.6E-09	7.7E-10	5.7E-10	1.2E-09	
NNW	2.4E-10	3.0E-10	3.3E-10	6.9E-10	3.2E-10	2.4E-10	5.1E-10	
NW	2.1E-10	2.5E-10	2.8E-10	5.6E-10	2.7E-10	2.1E-10	4.2E-10	
WNW	1.8E-10	2.1E-10	2.4E-10	4.8E-10	2.3E-10	1.7E-10	3.6E-10	
W	2.6E-10	3.2E-10	3.6E-10	7.1E-10	3.5E-10	2.6E-10	5.3E-10	
WSW	7.1E-10	8.6E-10	9.7E-10	2.0E-09	9.5E-10	7.0E-10	1.5E-09	
SW	4.6E-10	5.6E-10	6.3E-10	1.3E-09	6.1E-10	4.6E-10	9.5E-10	
SSW	6.2E-10	7.5E-10	8.5E-10	1.8E-09	8.3E-10	6.1E-10	1.3E-09	
S	5.8E-10	7.0E-10	7.9E-10	1.6E-09	7.7E-10	5.7E-10	1.2E-09	
SSE	5.5E-10	6.7E-10	7.5E-10	1.6E-09	7.3E-10	5.4E-10	1.2E-09	
SE	5.2E-10	6.2E-10	6.9E-10	1.4E-09	6.8E-10	5.1E-10	1.0E-09	
ESE	7.3E-10	8.8E-10	9.9E-10	2.0E-09	9.6E-10	7.1E-10	1.5E-09	
E	5.1E-10	6.1E-10	6.9E-10	1.4E-09	6.7E-10	5.0E-10	1.0E-09	
ENE	5.6E-10	6.7E-10	7.6E-10	1.6E-09	7.4E-10	5.5E-10	1.2E-09	
NE	6.1E-10	7.4E-10	8.4E-10	1.7E-09	8.2E-10	6.0E-10	1.3E-09	
NNE	1.2E-09	1.4E-09	1.6E-09	3.3E-09	1.6E-09	1.2E-09	2.4E-09	

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SUMMARY  
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INDIVIDUAL LIFETIME RISK (deaths)  
(All Radionuclides and Pathways)

Distance (m)

Direction 1129

N	1.2E-09
NNW	5.2E-10
NW	4.3E-10
WNW	3.6E-10
W	5.4E-10
WSW	1.5E-09
SW	9.7E-10
SSW	1.3E-09
S	1.2E-09
SSE	1.2E-09
SE	1.0E-09
ESE	1.5E-09
E	1.1E-09
ENE	1.2E-09
NE	1.3E-09
NNE	2.5E-09

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**PLANT 8 CONCRETE SHOT-BLASTING**

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EMISSION ESTIMATE  
PLANT 8 CONCRETE SHOT-BLASTING  
DEMONSTRATION

1 of 2

1. Average Radionuclide Concentration for Building 8A Concrete Chips.

NOTE: Only one result (13 total) was used for each page of results. Highest result reported on each page for each radionuclide was used to calculate the concentration for each radionuclide. Therefore, the radionuclide concentration reported below is actually higher than the actual average. Values used will be included in PEAPR files.

<u>Radionuclide</u>	<u>Concentration (pCi/g)</u>
$U^{238}$	1623
$U^{235}$	177.5
$U^{234}$	1747
$Th^{232}$	18.5
$Th^{230}$	87.4
$Th^{228}$	18.5
$Pb^{210}$	2.6
$Pu^{241}$	5.3
$Sr^{90}$	0.23
$Tc^{99}$	597

2. Concrete Emission Estimate.

A. ASSUMPTIONS

- o 137 ft<sup>3</sup> of concrete will be removed.
- o Density of concrete is 4000 lb/yd<sup>3</sup> (from App. A of AP-42).
- o Efficiency of grit blast vacuum system is 99% (does not include filters). Note: This is conservative. 40 CFR Part 61 Appendix D would allow use of 10<sup>-3</sup> as an emission factor for particulate matter.

B. TOTAL CONCRETE EMISSIONS

137 ft <sup>3</sup>	4000 lb	yd <sup>3</sup>	1 - .99	kg	= 92.05
	yd <sup>3</sup>	27 ft <sup>3</sup>		2.205 lb	kg-concrete

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EMISSION ESTIMATE  
PLANT 8 CONCRETE SHOT-BLASTING  
DEMONSTRATION

2 of 2

C. TOTAL CURIES PER YEAR

Formula:  $92.05 \text{ kg} \times (1000\text{g/kg}) \times \underline{\quad} \text{ pCi/g} \times (1 \text{ Ci}/1 \times 10^{12} \text{ pCi})$   
= total activity per year for radionuclide

<u>Radionuclide</u>	<u>Total Curies (Ci/yr)</u>
$\text{U}^{238}$	1.49E-4
$\text{U}^{235}$	1.63E-5
$\text{U}^{234}$	1.61E-4
$\text{Th}^{232}$	1.70E-7
$\text{Th}^{230}$	8.05E-6
$\text{Th}^{228}$	1.70E-6
$\text{Pb}^{210}$	2.38E-7
$\text{Pu}^{241}$	4.85E-7
$\text{Sr}^{90}$	2.12E-8
$\text{Tc}^{99}$	1.06E-6 (Ci/wk)

3. Process Ventilation System

A. ASSUMPTIONS

- o 2750 cfm flowrate
- o 120" high
- o 8" diameter discharge (guess) (0.35 ft<sup>2</sup> area)

B. EXIT VELOCITY

2750 ft <sup>3</sup>		minute	0.305 m	= 39.9 m/sec
minute	0.35 ft <sup>2</sup>	60 seconds	ft	

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C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S   R E P O R T

Non-Radon Individual Assessment  
Feb 10, 1998 9:44 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT  
Address: P.O. BOX 538704  
7400 WILLEY ROAD  
City: CINCINNATI  
State: OH Zip: 45253-8704

Effective Dose Equivalent  
(mrem / year)

1.87E-02

At This Location: 958 Meters North Northeast

Source Category: REMEDIATION SITE  
Source Type: Stack  
Emission Year: 1998

Comments: GRIT BLASTER BLDG 8 - CONCRETE REMOVAL DEMO  
REFLECT ACTUAL MAXIMALLY EXPOSED INDIVIDUAL

Dataset Name: 98P8CONCRETE  
Dataset Date: Feb 10, 1998 9:44 am  
Wind File: WNDFILES\FEMPSTD.WND

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Feb 10, 1998 9:44 am

SYNOPSIS  
Page 1

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 958 Meters North Northeast  
Lifetime Fatal Cancer Risk: 2.40E-07

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	4.40E-05
BREAST	4.98E-05
R MAR	1.71E-03
LUNGS	1.46E-01
THYROID	4.35E-05
ENDOST	2.25E-02
RMNDR	9.20E-04
EFFEC	1.87E-02

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SYNOPSIS  
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RADIONUCLIDE EMISSIONS DURING THE YEAR 1998

ide	Class	Size	Source	TOTAL
			#1 Ci/Y	
34	Y	0.30	1.6E-04	1.6E-04
35	Y	1.00	1.6E-05	1.6E-05
38	Y	0.30	1.5E-04	1.5E-04
228	Y	0.30	1.7E-06	1.7E-06
230	Y	0.30	8.1E-06	8.1E-06
232	Y	0.30	1.7E-06	1.7E-06
90	Y	1.00	2.1E-08	2.1E-08
99	W	1.00	1.1E-06	1.1E-06
210	Y	0.30	2.4E-07	2.4E-07
241	Y	1.00	4.8E-07	4.8E-07

SITE INFORMATION

Temperature: 12 degrees C  
Precipitation: 99 cm/Y  
Mixing Height: 950 m

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SYNOPS<sup>I</sup>  
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SOURCE INFORMATION

Source Number: 1

Stack Height (m): 3.05  
Diameter (m): 0.35

Plume Rise  
Momentum (m/s): 3.99E+01  
(Exit Velocity)

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.  
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1192	1680	1539	1243	2258	958	1071	1141	1256	1255
1405	1206	2319	1736	1692	1255				

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C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E   A N D   R I S K   E Q U I V A L E N T   S U M M A R I E S

Non-Radon Individual Assessment  
Feb 10, 1998 9:44 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT  
Address: P.O. BOX 538704  
7400 WILLEY ROAD  
City: CINCINNATI  
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE  
Source Type: Stack  
Emission Year: 1998

Comments: GRIT BLASTER BLDG 8 - CONCRETE REMOVAL DEMO  
REFLECT ACTUAL MAXIMALLY EXPOSED INDIVIDUAL

Dataset Name: 98P8CONCRETE  
Dataset Date: Feb 10, 1998 9:44 am  
Wind File: WNDFILES\FEMPSTD.WND

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	4.40E-05
BREAST	4.98E-05
R MAR	1.71E-03
LUNGS	1.46E-01
THYROID	4.35E-05
ENDOST	2.25E-02
RMNDR	9.20E-04
EFFEC	1.87E-02

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	6.54E-04
INHALATION	1.80E-02
AIR IMMERSION	3.75E-10
GROUND SURFACE	1.35E-05
INTERNAL	1.86E-02
EXTERNAL	1.35E-05
TOTAL	1.87E-02

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SUMMARY  
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NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	9.24E-03
U-235	5.26E-04
U-238	7.61E-03
TH-228	1.80E-04
TH-230	8.31E-04
TH-232	2.55E-04
SR-90	2.42E-08
TC-99	1.75E-07
PB-210	1.28E-05
PU-241	6.82E-07
TOTAL	1.87E-02

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SUMMARY  
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CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	1.65E-09
BONE	1.09E-09
THYROID	1.17E-11
BREAST	1.24E-10
LUNG	2.35E-07
STOMACH	7.43E-11
BOWEL	8.21E-11
LIVER	1.04E-10
PANCREAS	4.57E-11
URINARY	1.96E-09
OTHER	5.59E-11
TOTAL	2.40E-07

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	3.43E-09
INHALATION	2.36E-07
AIR IMMERSION	8.73E-15
GROUND SURFACE	3.12E-10
INTERNAL	2.40E-07
EXTERNAL	3.12E-10
TOTAL	2.40E-07

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NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	1.21E-07
U-235	6.90E-09
U-238	1.00E-07
TH-228	3.65E-09
TH-230	6.97E-09
TH-232	1.45E-09
SR-90	5.00E-13
TC-99	6.43E-12
PB-210	1.63E-10
PU-241	2.60E-12
TOTAL	2.40E-07

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SUMMARY  
Page 5INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)  
(All Radionuclides and Pathways)

Direction	Distance (m)						
	1192	1680	1539	1243	2258	958	1071
N	6.6E-03	3.8E-03	4.4E-03	6.2E-03	2.4E-03	9.4E-03	7.9E-03
NNW	2.8E-03	1.7E-03	1.9E-03	2.7E-03	1.1E-03	4.0E-03	3.4E-03
NW	2.3E-03	1.4E-03	1.6E-03	2.2E-03	9.0E-04	3.2E-03	2.7E-03
WNW	2.0E-03	1.2E-03	1.4E-03	1.9E-03	7.7E-04	2.8E-03	2.3E-03
W	2.9E-03	1.7E-03	2.0E-03	2.7E-03	1.1E-03	4.0E-03	3.3E-03
WSW	8.2E-03	4.7E-03	5.4E-03	7.6E-03	2.9E-03	1.2E-02	9.7E-03
SW	5.2E-03	3.0E-03	3.5E-03	4.8E-03	1.9E-03	7.3E-03	6.1E-03
SSW	7.3E-03	4.2E-03	4.8E-03	6.8E-03	2.6E-03	1.1E-02	8.7E-03
S	6.6E-03	3.9E-03	4.4E-03	6.2E-03	2.4E-03	9.5E-03	7.9E-03
SSE	6.4E-03	3.7E-03	4.2E-03	6.0E-03	2.3E-03	9.3E-03	7.7E-03
SE	5.5E-03	3.3E-03	3.8E-03	5.1E-03	2.1E-03	7.5E-03	6.4E-03
ESE	8.2E-03	4.8E-03	5.5E-03	7.7E-03	3.0E-03	1.2E-02	9.7E-03
E	5.7E-03	3.3E-03	3.8E-03	5.3E-03	2.1E-03	8.0E-03	6.7E-03
ENE	6.4E-03	3.7E-03	4.3E-03	6.0E-03	2.3E-03	9.2E-03	7.6E-03
NE	7.1E-03	4.1E-03	4.7E-03	6.6E-03	2.5E-03	1.0E-02	8.4E-03
NNE	1.3E-02	7.7E-03	8.9E-03	1.2E-02	4.8E-03	1.9E-02	1.6E-02

Direction	Distance (m)						
	1141	1256	1255	1405	1206	2319	1736
N	7.1E-03	6.1E-03	6.1E-03	5.1E-03	6.5E-03	2.3E-03	3.6E-03
NNW	3.0E-03	2.6E-03	2.6E-03	2.2E-03	2.8E-03	1.0E-03	1.6E-03
NW	2.5E-03	2.1E-03	2.1E-03	1.8E-03	2.3E-03	8.7E-04	1.3E-03
WNW	2.1E-03	1.8E-03	1.8E-03	1.6E-03	2.0E-03	7.4E-04	1.1E-03
W	3.1E-03	2.6E-03	2.7E-03	2.2E-03	2.8E-03	1.1E-03	1.6E-03
WSW	8.8E-03	7.5E-03	7.5E-03	6.3E-03	8.0E-03	2.8E-03	4.5E-03
SW	5.5E-03	4.8E-03	4.8E-03	4.0E-03	5.1E-03	1.8E-03	2.9E-03
SSW	7.9E-03	6.7E-03	6.7E-03	5.6E-03	7.2E-03	2.5E-03	3.9E-03
S	7.1E-03	6.1E-03	6.1E-03	5.1E-03	6.5E-03	2.3E-03	3.7E-03
SSE	6.9E-03	5.9E-03	5.9E-03	4.9E-03	6.3E-03	2.2E-03	3.5E-03
SE	5.8E-03	5.1E-03	5.1E-03	4.3E-03	5.4E-03	2.0E-03	3.1E-03
ESE	8.8E-03	7.5E-03	7.6E-03	6.3E-03	8.0E-03	2.9E-03	4.5E-03
E	6.1E-03	5.2E-03	5.2E-03	4.4E-03	5.6E-03	2.0E-03	3.2E-03
ENE	6.9E-03	5.9E-03	5.9E-03	4.9E-03	6.3E-03	2.2E-03	3.5E-03
NE	7.6E-03	6.5E-03	6.5E-03	5.4E-03	7.0E-03	2.4E-03	3.9E-03
NNE	1.4E-02	1.2E-02	1.2E-02	1.0E-02	1.3E-02	4.6E-03	7.3E-03

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INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)  
(All Radionuclides and Pathways)

Distance (m)

Direction	1692	1255
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N	3.8E-03	6.1E-03
NNW	1.6E-03	2.6E-03
NW	1.4E-03	2.1E-03
WNW	1.2E-03	1.8E-03
W	1.7E-03	2.7E-03
WSW	4.7E-03	7.5E-03
SW	3.0E-03	4.8E-03
SSW	4.1E-03	6.7E-03
S	3.8E-03	6.1E-03
SSE	3.6E-03	5.9E-03
SE	3.3E-03	5.1E-03
ESE	4.7E-03	7.6E-03
E	3.3E-03	5.2E-03
ENE	3.7E-03	5.9E-03
NE	4.0E-03	6.5E-03
NNE	7.6E-03	1.2E-02

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SUMMARY  
Page 7INDIVIDUAL LIFETIME RISK (deaths)  
(All Radionuclides and Pathways)

Direction	Distance (m)						
	1192	1680	1539	1243	2258	958	1071
N	8.5E-08	4.9E-08	5.6E-08	7.9E-08	3.0E-08	1.2E-07	1.0E-07
NNW	3.6E-08	2.1E-08	2.4E-08	3.4E-08	1.3E-08	5.1E-08	4.3E-08
NW	2.9E-08	1.7E-08	2.0E-08	2.7E-08	1.1E-08	4.1E-08	3.4E-08
WNW	2.5E-08	1.5E-08	1.7E-08	2.3E-08	9.3E-09	3.5E-08	3.0E-08
W	3.6E-08	2.2E-08	2.5E-08	3.4E-08	1.4E-08	5.0E-08	4.2E-08
WSW	1.0E-07	6.0E-08	6.9E-08	9.8E-08	3.7E-08	1.5E-07	1.2E-07
SW	6.6E-08	3.8E-08	4.4E-08	6.2E-08	2.4E-08	9.3E-08	7.8E-08
SSW	9.4E-08	5.3E-08	6.1E-08	8.7E-08	3.2E-08	1.3E-07	1.1E-07
S	8.5E-08	4.9E-08	5.6E-08	7.9E-08	3.0E-08	1.2E-07	1.0E-07
SSE	8.2E-08	4.7E-08	5.4E-08	7.7E-08	2.9E-08	1.2E-07	9.8E-08
SE	7.0E-08	4.2E-08	4.8E-08	6.6E-08	2.7E-08	9.6E-08	8.2E-08
ESE	1.0E-07	6.1E-08	7.0E-08	9.8E-08	3.8E-08	1.5E-07	1.2E-07
E	7.2E-08	4.2E-08	4.8E-08	6.8E-08	2.6E-08	1.0E-07	8.5E-08
ENE	8.2E-08	4.7E-08	5.4E-08	7.7E-08	2.9E-08	1.2E-07	9.8E-08
NE	9.1E-08	5.2E-08	6.0E-08	8.5E-08	3.2E-08	1.3E-07	1.1E-07
NNE	1.7E-07	9.9E-08	1.1E-07	1.6E-07	6.2E-08	2.4E-07	2.0E-07

Direction	Distance (m)						
	1141	1256	1255	1405	1206	2319	1736
N	9.1E-08	7.8E-08	7.8E-08	6.5E-08	8.3E-08	2.9E-08	4.6E-08
NNW	3.9E-08	3.3E-08	3.3E-08	2.8E-08	3.5E-08	1.2E-08	2.0E-08
NW	3.1E-08	2.7E-08	2.7E-08	2.3E-08	2.9E-08	1.1E-08	1.6E-08
WNW	2.7E-08	2.3E-08	2.3E-08	1.9E-08	2.5E-08	8.9E-09	1.4E-08
W	3.9E-08	3.3E-08	3.4E-08	2.8E-08	3.6E-08	1.3E-08	2.1E-08
WSW	1.1E-07	9.6E-08	9.6E-08	8.0E-08	1.0E-07	3.6E-08	5.7E-08
SW	7.0E-08	6.1E-08	6.1E-08	5.1E-08	6.5E-08	2.3E-08	3.6E-08
SSW	1.0E-07	8.6E-08	8.6E-08	7.1E-08	9.2E-08	3.1E-08	5.0E-08
S	9.1E-08	7.8E-08	7.8E-08	6.5E-08	8.3E-08	2.9E-08	4.6E-08
SSE	8.8E-08	7.5E-08	7.6E-08	6.3E-08	8.1E-08	2.7E-08	4.4E-08
SE	7.4E-08	6.5E-08	6.5E-08	5.5E-08	6.9E-08	2.6E-08	4.0E-08
ESE	1.1E-07	9.6E-08	9.6E-08	8.1E-08	1.0E-07	3.6E-08	5.8E-08
E	7.7E-08	6.7E-08	6.7E-08	5.6E-08	7.1E-08	2.5E-08	4.0E-08
ENE	8.8E-08	7.5E-08	7.5E-08	6.3E-08	8.0E-08	2.8E-08	4.5E-08
NE	9.7E-08	8.3E-08	8.3E-08	6.9E-08	8.9E-08	3.1E-08	4.9E-08
NNE	1.8E-07	1.6E-07	1.6E-07	1.3E-07	1.7E-07	5.9E-08	9.4E-08

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INDIVIDUAL LIFETIME RISK (deaths)  
(All Radionuclides and Pathways)

Distance (m)

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Direction	1692	1255
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N	4.8E-08	7.8E-08
NNW	2.1E-08	3.3E-08
NW	1.7E-08	2.7E-08
WNW	1.5E-08	2.3E-08
W	2.1E-08	3.4E-08
WSW	5.9E-08	9.6E-08
SW	3.8E-08	6.1E-08
SSW	5.2E-08	8.6E-08
S	4.8E-08	7.8E-08
SSE	4.6E-08	7.6E-08
SE	4.1E-08	6.5E-08
ESE	6.0E-08	9.6E-08
E	4.2E-08	6.7E-08
ENE	4.6E-08	7.5E-08
NE	5.1E-08	8.3E-08
NNE	9.8E-08	1.6E-07

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